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The ELECTRICAL REVIEW

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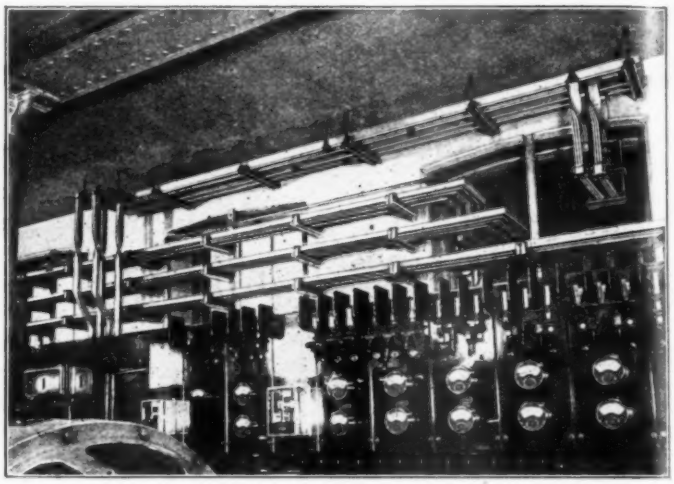

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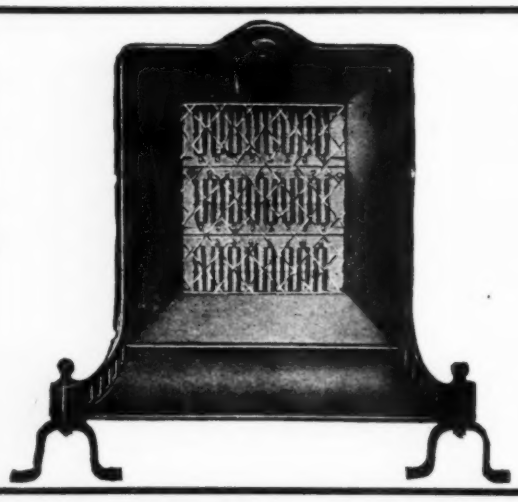

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Electrical Review

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Service.

IN a number of recent articles we have endeavoured to emphasise the extreme importance, from the national point of view, of safeguarding, maintaining, and developing the home market. We make no apology for alluding to this point once more, for the truth bears repetition, and frequently needs a deal more hammering home than half-truths and whole-truths which may be specious and plausible at first sight, but which prove, on examination, to be worthless and empty.

That orders for electrical goods have been placed abroad is largely a matter of price—it is not that our workers are untrained or inefficient or that we cannot make what is required—but if production can be sufficiently stimulated, by whatever means, the tendency will be for prices to fall, and it will then be easier for timid souls to show a preference for goods which give our own people employment.

When cheapness of production has been achieved, it becomes easier to make greater progress in the development of the export market. Many important traders have lately stressed in public speeches the importance of finding new markets. The electrical trade has had this matter kept before it persistently by ourselves and others for many years past. The present situation emphasises its importance, and the departure of British electrical trade-seekers on overseas campaigns or tours is noteworthy and gratifying. Some manufacturers are already well represented in the overseas Dominions and in foreign countries, and those firms which are so fortunately placed have an opportunity of exercising the arts of salesmanship, of getting into contact with the customer, and of anticipating likely developments. All, but particularly the less wealthy firms, who are obliged to work from home, must depend on quality, service, and price. If the quality and service can be taken for granted, price will tell; and since, in many Dominions, the electrical industry is to some extent established, it

may be taken as a fundamental necessity that it shall be possible to use the inducement of cheapness. In the ordinary way, the importer must sell at a lower price than the home producer.

If production for the British home market has been sufficient to bear overhead charges and to give reasonable hope of profit, it is perfectly sound to accept export orders at prices which do not bear such heavy charges, and upon which the profit may appear to be very small. The load factor of the works will thereby be improved, and it will ultimately be found that the extra profit gained by accepting such additional business is considerable.

The uses to which this extra profit can be put are numerous. Perhaps the increasing of dividends is the most obvious, and this is important if there is to be general confidence in the state of the industry; but the electrical industry is essentially an industry of service. In this connection it may be held that the example of Mr. Henry Ford indicates that service may prove to be its own exceedingly valuable reward, though we have no evidence to prove what would happen if all industry were run competitively on the Ford principle. As an industry of service, possibly it would be helpful in many ways to devote part of the extra electrical profit to the reduction of prices in the home market. Demand would thereby be stimulated, and still more efficient production could be achieved; and the reduction of the home selling price would have the effect of lowering the duty imposed upon imports in many of the overseas Dominions.

Foreign competition in electrical goods was eliminated during the war, and it has not yet reached serious dimensions. We hope it never will, but if we are to prevent it, it will only be by the most active constructive efforts on the part of those concerned. There is no lack of will on the part of the foreigner. German competition was serious before 1914, but to-day Swedish and Swiss competition fills most of the picture. Those buyers who have visited some of the foreign works, report that as regards research, technical data, and availability of information, our British organisations are being set a copy which will take some living up to. The necessity of research, though recognised in some quarters, is far from being regarded by all as the vital thing it really is, and there is too much lag between the laboratory and the shop in many of those factories in which research is undertaken. Further, although the needs of the armed forces of the Crown during the war raised the standard of equipment in many places, and increased equipment in others, there is still much to be done in this direction.

But in our view the most crying need at present is for improvements in organisation, so that goods may be available for prospective users with a minimum of complication and fuss. We have a flourishing Electrical Development Association engaged in preaching the gospel of electricity; the I.M.E.A. enthuses (behind closed doors) at Scarborough until the atmosphere, as one speaker remarked at the time, resembles that of a revival meeting; but what is there for the average non-technical man or woman in whom the desire for things electrical may be created? He or she knows nothing of the electrical contractor; the electric supply authority, in most cases, has no trading powers; the manufacturer seldom deals direct; and generally speaking it is far too difficult to set the ball rolling. Direct dealing with the huge and (from the customer's point of view) over-organised concerns results in the accumulation of forty or fifty documents over the purchase of a few domestic oddments, and all this kind of thing costs money, besides being very alarming to those who are unaccustomed to it.

Many of the best commercial brains of the industry have for years been devoted to securing co-operative action among manufacturers for the protection of their own interests. The work they have done was very necessary, and has been extremely useful. If the same efforts could now be put into the development of the idea of *service* (and we know the desirability of this is realised in very influential quarters), we think it would give the greatest possible impetus to the development and preservation of the home market for home suppliers.

The Lead-Hydrate Storage Battery.

In March, 1922, under the adjoining heading, we published an account of a storage battery, new to the English market, regarding which statements were made which we characterised as "astounding claims," involving as they did an enormous increase in capacity, immunity from sulphating and local action, and very long life. These claims were quoted "not as our own, but as the maker's statements," but we pointed out that the battery was "launched in this country under the aegis of most substantial parents and god-parents," whose word would not be lightly questioned, and who invited the fullest possible inquiry into their accuracy. As we stated at the time, had they not been thus powerfully supported, we should have declined to publish them "unless and until we were furnished with positive proofs of their substantiation"; and we further said: "Verification of the claims made by the makers and quoted on an earlier page would, of course, occupy a long time, some of them involving periods of years, and consequently we take no responsibility for them."

In view of the remarkable statements that were made, implying that a revolution in storage battery manufacture was impending, great interest was aroused in the subject, and the new "foolproof" cells were eagerly awaited; but as time passed and no startling results were forthcoming, doubts arose as to the validity of the claims that had been made. From time to time we communicated with the makers on the subject, and recognising the many difficulties that beset the manufacture of a new battery, we forbore to press them unduly, on the understanding that when a reasonable period had elapsed we should return to the matter and report progress. That period has matured, and the makers of the battery, Messrs. Siebe, Gorman & Co., Ltd., agree with us that it is due to the industry and to ourselves to issue a frank statement as to the present position.

We understand that the inventor of the lead-hydrate accumulator, whose enthusiasm unfortunately far outran his achievements, is now engaged in operations on his own account elsewhere. We are informed that batteries are being manufactured by Messrs. Siebe, Gorman & Co. for motor-car lighting and starting, and for house lighting, &c., by the lead-hydrate process, under expert supervision, and very satisfactory results have been obtained, batteries which have been in commercial operation on motor transport vehicles for nine months under very severe conditions having stood up to their work with no apparent deterioration. Especial satisfaction is expressed with the condition of the active material, there being very little deposit in the containers. The exaggerated statements originally issued by the company are reduced to modest dimensions, but adhered to in principle—*i.e.*, it is claimed that there is a material increase in capacity for the same weight of active material and an equally increased longevity. The life tests, of course, cannot be completed quickly, but exhaustive capacity tests have been carried out.

The obvious inference from the foregoing remarks is that Messrs. Siebe, Gorman & Co., Ltd., were, in good faith, misled in the first instance; they are now engaged in developing on sound lines a battery which they believe to embody material improvements and to possess advantages which, whilst in no way sensational, will fully justify its manufacture.

Electric Brass Furnaces.

THE American Electrochemical Society has done as much as any other body either in America or England to further the claims of the electric furnace for both ferrous and non-ferrous metals, and an important conference which confined its discussions to electric brass furnaces was held in Ohio recently; instances were given of foundries that expressed a preference for the electric-furnace method of melting, owing to the superior quality of metal obtained. In this country the application of electricity to the melting of brass and copper alloys has made little progress, mainly owing to its relatively higher opera-

ting costs and without regard to the quality of the metal. Electric furnaces are more frequently used for non-ferrous alloys that are to be rolled than for the production of castings required as such. A cleaner alloy is undoubtedly produced, and this compensates for the additional cost of melting when it is to be rolled.

In America many of the largest works have given up coke for melting, and it has been computed that over 400 electric furnaces are employed in connection with the non-ferrous metal industry, many of them melting a ton or more. The electric current is so flexible and adaptable that it should be of very exceptional value for melting alloys that have to be carefully dealt with; it is not altogether a question of furnace design. Professor Turner stated two years ago that, speaking not as an electrical engineer, but as a metallurgist, it appeared to him that what was required was a definite supply of electricity suitable for the purpose and more or less devoted to that purpose if a large metallurgical industry was ever to be carried on dependent upon electric melting.

It has frequently been pointed out that the three main characteristics of brass, from the point of view of electric melting, are the volatility of the zinc contained in it and the rate of heat conduction through the molten brass. Arc furnaces are now generally used, although the arcs are not, as a rule, in direct contact with the metal, and with a high zinc content the losses are severe. Zinc boils at 930 deg. C. and lead at 1,580 deg., and it is evident that these metals must be kept from contact with the arc when melted; hence the need for indirect arc heating is clearly evident. Owing to the upper walls of the furnace becoming exceedingly hot, rocking is invariably resorted to, so that the metal cools them. Experts are agreed that no one type of furnace is suited for all conditions of service. A furnace suitable for melting red brass may be a failure for yellow brass or other alloys having a high zinc content, and one that is capable of dealing with very large melts may have a low efficiency when dealing with small ones. Also a furnace suitable for continuous service may not be economical when operated only for a few hours at a time. Some critics are prejudiced against electric melting because it is not as easy to change from one mixture to another as in coke, gas, and oil furnaces, but this is a minor matter.

There are other problems concerning suitable refractories that have not been finally solved. Much work remains to be done both by electrical engineers and by non-ferrous metallurgists, although there are some excellent furnaces on the market now. The number of small brass foundries in Great Britain employing one or two men is huge and will form a potential market when the price of electrical energy is reduced, because electricity would be a much more convenient fuel than coke, and a very large majority use coke at the present time.

Company Formation in Germany.

DEALING with the new capital requirements of German Industries in 1923, a Frankfort newspaper publishes a tabular statement showing that in the two groups represented by electricity and gas works, 139 companies increased their share capital last year as compared with 131 in 1922. The number of new companies formed in these industries in 1923, including undertakings converted into share companies, amounted to 206, as contrasted with 55 in the preceding year. We omit the amounts of the capital increases, and of the nominal capital of the new companies, as they are set forth in millions of paper marks, which would convey no definite information, owing to the great fluctuations in the rate of exchange which occurred last year. It may be noted, however, that funds were raised by the electrical industry also in the form of loans and, as in 1922, the most prominent part in this direction was taken by the large hydro-electric works in the South of Germany, which are in course of construction or extension.

Sweden's Engineering Exports.

THERE are a number of noteworthy points in an analysis of Sweden's export trade in "mechanical products," which was published in the December issue of the *Swedish Economic Review*, which is a publication compiled by the Swedish Board of Trade. The bulk of these products is naturally absorbed by Europe, only 15 per cent. being sent further afield. Great Britain occupies the fourth place, with 6 per cent., in the list of customer countries, the first three being Russia, Norway, and the Netherlands, respectively. Russia is by far the most important; during 1922 she absorbed more than a third of Sweden's engineering products. No doubt the large locomotive orders placed by the Soviet Government in Sweden accounted largely for this. Telephone and telegraph apparatus were also taken to the extent of 21 per cent. by Russia. Great Britain is one of the largest "consumers" of Swedish electrical machinery, occupying the fourth place (10 per cent.) with Spain. In this branch, Russia only figured to a small extent.

Cuba's Recovery.

IN the British Consul-General's report on Cuban commercial conditions there is much to encourage the British merchant to increase his efforts in that market. It is true that the special position of the United States renders her predominant in Cuba's foreign trade, but the Consul points out that Great Britain at present takes second place as a supplier. Cuba is well on the way to recovery again, and on account of her great sugar resources is largely improving her capacity for the consumption of manufactured goods. The Consul-General says that British trade in no way escaped from the general depression prevailing during the past few years, and British traders lost a great deal of money. There are, however, distinct signs of improvement, and no effort should be spared by British firms to enter or re-enter this market.

Prices generally have declined in the United Kingdom, and in several lines are now under the United States prices. Therefore, in spite of competition, geographical disadvantages, tariff discriminations, &c., British trade is making headway.

Better shipping facilities, more representatives, and a closer study of Cuban conditions would tend to accelerate progress, but British traders, says the Consul-General, seem still to nourish some distrust of this market and are not always prepared to grant the terms other countries grant.

There has been during the last few months some depression in the local trade, but more and more firms in Cuba, some of very good standing, are betraying interest in British offers, and endeavouring to make British connections.

Radio Broadcasting.

THE discussion on "Broadcasting" at the Informal Meeting of the Institution of Electrical Engineers on Monday last was opened by Mr. E. H. Shaughnessy, O.B.E., with an address upon which he is to be cordially congratulated; not only was it excellent in substance and broad in scope, but also it was admirably delivered and enlivened with frequent flashes of humour which were highly appreciated by the large audience. We are so constantly wearied with the continual repetition of the syllable "Er" at Institution meetings that it was refreshing to mark its absence from Mr. Shaughnessy's fluent utterance.

Referring to the complaints of interference which are received from the users of valve sets, the speaker pointed out that it was the aim of the B.B.C. to bring its service within the reach of crystal receivers throughout the Kingdom, and that it was not intended that listeners within that range should endeavour to receive the programmes of distant stations. Going to the opposite extreme, a speaker in the discussion stated that the transmission from the American station KDKA was now sent out with 18 kW, on a wave length of 102.5 metres, and that it could easily be heard any evening after 9 p.m. with an ordinary 3-valve set, suitably tuned.

The Million-volt Testing Plant at Ivry.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E.

ON the occasion of the Extra-High-Pressure Transmission Conference held at Paris, the delegates visited the new "Ampere" super-laboratory of the Cie Générale d'Electro-Céramique (see ELECTRICAL REVIEW, Vol. XCIII, December 28th, 1923). This laboratory, which was opened just before the official visit, is quite a new establishment, and contains testing plant of the highest voltage in Europe. The visitors were greatly impressed by the enormous capacity of the building required for housing testing plant of such high voltage—not without good reason. The author remembered some tests made in America, some 15 years ago, with a half-million volt transformer, where the designers overlooked the necessity for ample space, and trouble was caused by flashing-over to the building itself.

In the Ivry testing plant, it was interesting to see the bluish brush discharge on the extra-high-pressure chain insulators under test gradually increasing with the voltage until at a million volts a great fat arc flashed across between the discharge balls with a terrifying report, leaving a strong smell of ozone and nitrous oxide in the air. It is of interest to note that on entering the Laboratory, in addition to signing the usual visitors' book, it was necessary to sign a separate declaration exonerating the owners from responsibility for any accidents, which however were very unlikely to occur, as all high-pressure parts were suspended from the roof.

The Laboratory was designed by the Cie Générale d'Electro-Céramique, in order to provide adequate plant for making electrical tests on insulators for transmission lines operating at 220,000 volts (such as the Rhône-Paris and Big Creek Power Co.'s schemes).

It was necessary to provide considerable space for the testing plant, in order to eliminate as far as possible the earth influence due to ground, walls, &c., the dimensions of the building being as follows:—

Length, 118 ft. (36 metres);
Width, 69 ft. (21 metres);
Height, 71 ft. (21.5 metres);
Floor area, 29,380 sq. ft. (2,730 sq. metres).

As the building contains no windows, complete darkness can be obtained. When required, the leading-out cables, carrying a pressure of one million volts above earth, can be taken out through a large opening (37 ft. by 37 ft.) (11.5 by 11.5 metres), which is normally closed by means of metallic curtains.

The transforming apparatus is installed on the lower floor, above which the working floor of the laboratory is raised. A gallery above the upper floor enables the operators to observe the electric phenomena in darkness without danger.

Owing to possible voltage wave form distortion and to variations in voltage, it is not possible to take current directly off the town supply. The electrical equipment, therefore, includes a motor-generator set. This consists of a 190-h.p. synchronous motor driving a 300-kVA three-phase, 50-period, 8-pole alternator. The voltage is 550 volts (between phase and neutral), and the pressure wave curve does not differ by more than 2 per cent. from a true sine wave whatever the load may be.

Two automatic circuit-breakers are provided for safety—one between the supply and the synchronous motor, and the other between the generator and the transformers. The group consists of three single-phase air-cooled units, each of 125 kVA at 375 kilovolts.

From the results of preliminary tests, it appears that the power consumption for all flash-overs at 350 kilovolts is approximately 6 to 7 kilowatts (the current is 0.3 ampere at 375 kV, corresponding to 112 kVA).

Two of the transformers connected in series with neutral points earthed give 250 kilovolts (or 150 kVA at 650 kilovolts if one pole is grounded). The three transformers in series, with one pole grounded, give 160 kVA at one million volts. With the three units star-connected and the neutrals earthed, the capacity would be 375 kVA at 650 kilovolts across phases. Arcing can be maintained without danger for an almost indefinite period, and the capacity is sufficient to maintain an arc of considerable intensity.

Formerly high-pressure testing transformers were invariably oil insulated. As the need for higher and yet higher voltages has arisen owing to the continued development of power transmission, increased difficulty has been experienced in obtaining the necessary test voltages. Although oil-insulated transformers usually occupy less space, it has been found that the air-insulated transformer presents an easier solution of what is a very difficult problem. One of the disadvantages of oil insulation in these very-high-voltage testing transformers is the decomposition of the oil which occurs, causing in its turn breakdowns between the secondary winding and the frame. Another difficulty is that presented by the leading-out bushes, the dimensions of which increase rapidly as the rated voltage is raised. In order to avoid these two main troubles, Messrs. Emile Haefely and Co., the well-known Swiss firm of manufacturers of

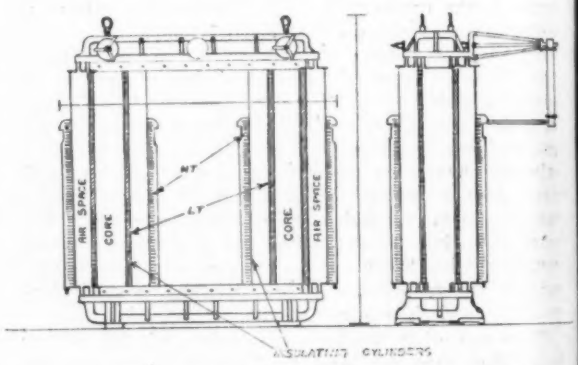


Fig. 1.—Sectional Elevation of Air-Insulated Transformer.

insulating materials at Basle, have turned their attention to the design and manufacture of air-insulated transformers with considerable success. The transformers installed at Ivry were built by them, and are of the air-insulated type.

As will be seen in fig. 1, the design follows the usual core type construction, the modifications being mainly in the insulation between windings and to ground, and in the connection of the coils. Over the low-pressure coil is placed a thin cylinder of insulating material having a fairly high specific inductive capacity. The high-pressure winding is lined with a similar cylinder, but of much greater diameter. The radial thickness of the air enclosed between the two cylinders is such that even at the maximum voltage required, no dangerous dielectric stress occurs. Thus, bearing in mind Fessenden's effect, it will be seen that the real insulation is air. The function of the insulating cylinders—apart from the light mechanical purpose they serve—is to distribute the electrostatic field uniformly, and so prevent dangerous concentration which would induce breakdown. The high-pressure windings receive a very thorough vacuum impregnation to render them proof against dampness, temperature variations, and dust. The mid-point is connected to the frame, and consequently the maximum potential to core is only half the terminal voltage at any time. To protect the terminal coils, guard rings are fitted, as in the usual oil transformer practice.

It is claimed that the total weight of an air-insulated high-pressure transformer is only 30 per cent. of that of a corresponding oil transformer. Moreover, the absence of a tank means also the elimination of the leading-out bush problem, with a further reduction in cost.

There are also some technical advantages to the credit of the air-insulated tester. For instance, owing to the great distance between the high- and low-pressure windings, the regulation is not so close. This is an advantage, as, on puncture or flash-over, the voltage is automatically reduced. Again, owing to the lower specific capacity and the greater distnces than in the oil transformer, voltage wave form distortion is less likely to occur. In this connection the curves in fig. 2 are of interest. Curve A shows the no-load current of a 200-kVA, 300,000-volt air transformer, with the high-pressure coils removed (*i.e.*, no capacity). Curve B shows the power factor under the same conditions. Curve C gives the no-load current for the transformer complete with high-pressure winding, while curve D shows the corresponding power factor. The effect of capacity is to increase the no-load current. For the transformer in question the increase was 14.5 per cent., but an oil-insulated transformer of 200,000 volts showed an increase of 33 per cent. in the no-load current when tested in the same manner. The designers claim that this comparison represents approximately the respective values of the capacities in the air-insulated and oil-insulated types.

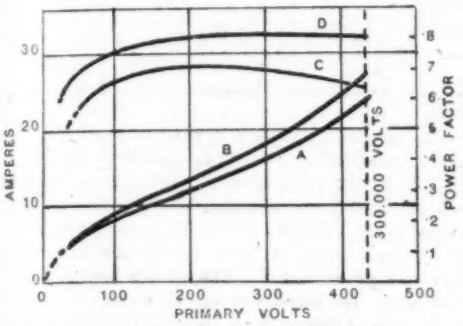


Fig. 2.—No-load Current of Transformer.

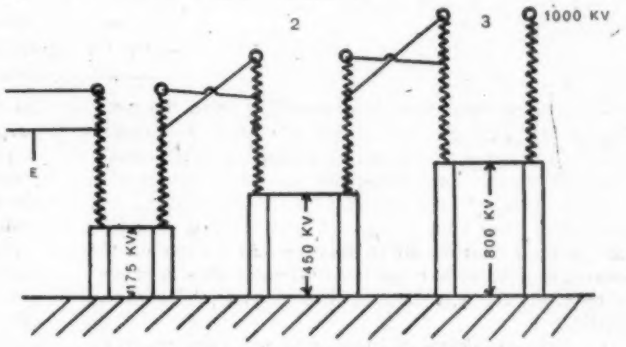


Fig. 3.—Connections to give 1,000,000 Volts.

The no-load losses in the tranformer are approximately 8 kW, even with ordinary transformer iron. After two hours' run, a temperature rise of 40 deg. C. was observed in the core, so that for testing purposes, oil is not missed from a thermal viewpoint.

The Ivry transformers are auto-connected, wound for 500 volts/375,000 volts, and are provided with compounding coils, to reduce leakage; as the middle points of the windings are connected to the cores, the second and third transformers are supported on special insulating pillars. Thus when the three are connected in series, the middle points are respectively 175 kV, 450 kV and 800 kV above earth potential. Fig. 3 shows the arrangement diagrammatically.

As an indication of the economy resulting from the use of such transformers, it is worthy of notice that the third transformer, complete with its insulating supports, weighs only 12.8 tons.

As those know who have had practical experience of high-voltage testing, one of the most important things to know is what potential is really being attained. At the Ivry laboratory the matter is being closely studied.

At present, spark gaps are used, consisting of spheres about three feet (1 metre) in diameter, which are adjustable from the control boards and calibrated in accordance with Peek's curves, and with the equivalent ratio curve of the transformers, checked at lower voltages with other gaps having spheres of smaller diameters, about 19½ inches (500 mm.) and 29½ inches (750 mm.), connected across portions of the windings.

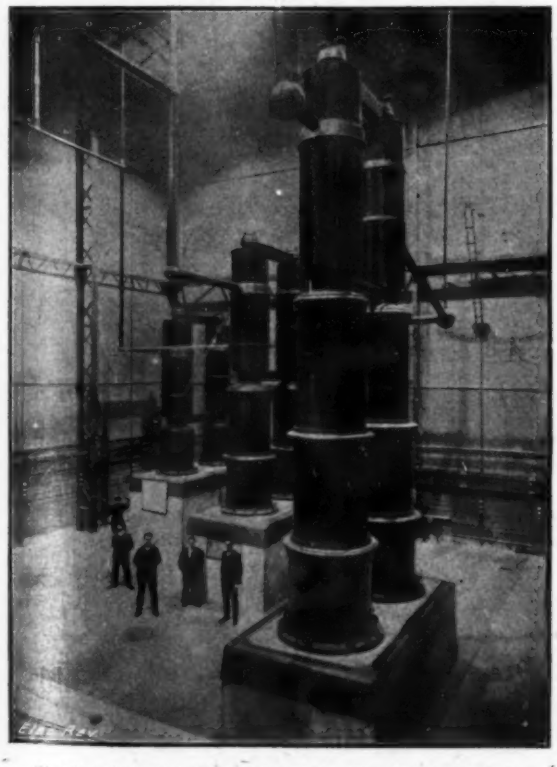
In the near future more accurate methods of voltage measurement will be adopted. One such method which it is proposed to try will make use of an air condenser, and is based on the measurement of maximum current. It is expected that the results will have an error of less than 2 per cent.

For the purpose of carrying out puncture tests on large insulators, an oil tank is provided in the operating floor. It has a diameter of about 16½ ft. (5 metres) and a capacity of about 1,060 cu. ft. (30 cu. metres). Puncture tests up to 600 kV can be made. Provision is being made for heating the oil up to 212 deg. F (100 deg. C.) during tests.

A special overhead line (three-phase, 220 kV, to test up to 650 kV) has been constructed in the yard outside the laboratory, to enable tests to be conducted under all weather conditions, viz., fog and rain. A special device provides artificial rain to the extent of about 0.04 in. (1 mm.) to 0.19 in. (5 mm.) per minute.

Porosity tests can be made with pressures up to about 21,500 lb. per sq. in. (1,500 kg. per square cm.).

The Laboratory will shortly be equipped with a mechanical testing plant consisting of several 500-ton hydraulic presses, with other mechanical devices for making traction, flexure, compression, and shock tests. A number of combined electrical and mechanical tests will also be arranged for.



(Note that the insulating pedestals are larger than the transformers which they support.)

Fig. 4.—"Million-Volt" Testing Transformers in the Ampere Laboratory.

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High-frequency tests will be carried out as soon as the necessary apparatus is installed. This will include an oscillator comprising a Tesla transformer with a group of condensers and sphere gaps. Frequencies of from 200,000 to 250,000 cycles per second and potentials of 200 kV above ground will be obtained.

A feature of the laboratory's work will be research on ceramic and electrical problems. To this end a very complete equipment has been provided to deal with every aspect of the subject. With the facilities which this institution possesses, far-reaching developments may be expected. Extra-high-pressure transmission has already progressed rapidly in the last decade, but each step has brought within sight the means of further advance, so that never were the possibilities for progress so great as they are to-day.

The Lesson of Fulham.

By "PERTINAX."

IT is to be regretted that in commenting upon the recent dispute at Fulham the technical Press in general scarcely exhibited the impartial judgment which usually characterises it. In making this assertion, one must in fairness specially exempt the ELECTRICAL REVIEW. As its readers have long recognised and learned to expect, that journal does on all occasions—and no less on this—endeavour to view facts from all sides and to express its opinions thereon in an unbiased and perfectly fair manner.

Generally speaking, a great deal was said about the action taken by the E.P.E.A. at Fulham and comparatively little about the causes which led up to such action being adopted. The dispute raises several issues of great importance, which merit careful consideration by all who are interested in the efficiency and stability of the electricity supply industry, and it is highly desirable that these issues should be considered dispassionately in order that some guidance may be obtained as to the general lines of procedure in the future.

To those who hold the dogmatic view that under no circumstances whatsoever should the maintenance of supply be jeopardised, it is difficult, if not impossible, to submit a satisfactory explanation of the attitude of the Association. Such an opinion has been expressed, and the writer protests most strongly against the postulating of such a condition, which would render the functioning of a protective organisation as such entirely nugatory. To those who recognise that there may be occasions when the staff are warranted in taking up a definite attitude in opposition to this, some considerations may be put forward.

In essence, the original cause of the Fulham dispute was the refusal of the Corporation to adhere to the arrangements laid down by the District Joint Council in respect of the dustmen. The other municipal employés gave their solid support to the dustmen in their refusal to accede to this variation of the decision of the recognised Whitley Council, because they were convinced that a vital principle was at stake. The E.P.E.A. members thus found themselves face to face with a situation which was none of their devising.

The Association had to choose whether it should throw its weight on the side of the Corporation which had violated an agreement and so defeat the men who were standing out for something to which they were justly entitled, or whether it should throw its weight in the scale against those who were assailing the principle of Whitleyism, even at the risk of imperilling the supply. It chose the latter alternative, because it looked upon the sanctity of agreements as being more fundamental than even continuity of supply.

The fact that the trouble arose in another industry has very little point. It is indisputable that the Corporation which had broken an agreement was the same Corporation that controlled the supply undertaking. It is idle to attempt to separate the public of Fulham in their capacity as ratepayers from their capacity as consumers of electricity. Their representatives did not scruple to sacrifice employés in one department in order to violate an agreement: that they suffered as regards their supply of electricity may seem hard, but need not occasion so much indignant surprise.

The E.P.E.A. has always regarded itself as a champion of Whitleyism. Wisely or unwisely it has nailed the colours of Whitleyism to the mast, and it has proclaimed its adherence to this ideal from the housetops. The ELECTRICAL REVIEW stated as its opinion that "to interrupt the supply in order to uphold Whitleyism is a Gilbertian procedure." The writer believes that for the E.P.E.A. to have agreed to supervise imported labour in this instance, and thus actively to support a corporation which was obdurately violating an agreement of a Whitley Council against men who were upholding the Whitley principle, would have been even more truly Gilbertian.

The ordinary citizen, if he is rash enough to defy law and order, for selfish reasons or merely out of devilment, is promptly arrested by a policeman, and has it demonstrated to him that such conduct may not be indulged in with impunity. Should he resist arrest, force is employed in order to effect his custody, because the preservation of law and order is based ultimately upon force. To use force in order to secure peace is no new phenomenon; it is an accepted concomitant of civilisation. To look on passively while disorder is in progress is but to encourage the spread of lawlessness. How much worse then is it actively to aid and abet it.

In the industrial world to-day neither employers nor employed have yet learned that it is the best policy to adhere honourably to agreements, and until they have done so some kind of compulsion will be necessary.

Having accepted this proposition, it will become obvious that the weight of enlightened opinion should be on the side which is endeavouring to uphold an agreement, and be against the side which is violating one.

It may be pointed out that the position of the technical staff during a dispute with which the manual workers are concerned is always a difficult one, and the former are almost inevitably faced with a choice of two evils. Absolute neutrality on their part is a practical impossibility. There was no middle course open to the E.P.E.A. in the Fulham case. Either it joined in upholding its declared principles or it actively assisted a defaulting corporation to violate them. To keep the job running was not a passive *rôle*, but an active one.

In discussing a dispute such as this, one must keep clearly in mind that there are these two propositions of fundamental importance involved, *viz.*:—

(1) That agreements between employers and employed which have been negotiated by the recognised machinery for the industry must be upheld.

(2) That in a vital industry such as electricity supply it is imperative that continuity should not be endangered unless for reasons of overwhelming weight.

Both these propositions are compatible, but it does not always follow that there may not be occasions when they clash. When the first is not adhered to, the second is prejudiced, and this is what occurred at Fulham. The solution to the problem when the two propositions are at variance depends upon the pre-

eminence which is given to one over the other. The view to which the Association tenaciously clings is that the first is of paramount importance and that no industry can prosper, or deserves to prosper, so long as those engaged in it have not learned the elementary principle of honour. Even continuity of supply is not so important as the honouring of agreements, which is fundamental. There appears to be a tendency amongst engineers to erect continuity of supply into a fetish which must be preserved on all occasions and to which everything else is to be sacrificed. The Association recognises that continuity of supply is of great importance, but it is far-sighted enough to see that while there are corporations ready to throw overboard agreements and to repudiate constitutional machinery, so long will an uninterrupted supply be in jeopardy. One could wish that the energies of all those who believe in stability should be bent on bringing this truth home rather than on criticising the E.P.E.A. for doing what it thought to be the right thing under the circumstances.

The writer has noticed of late, in a portion of the Press and in other quarters, a trend in the direction of discounting the principle of Whitleyism in industry. The exigencies of wartime, which inculcated the desirability of the establishment of some such system, have ceased to exist, and there appears to be a tendency to revert to the older methods of selfishness and mutual antagonism. This is regrettable in the extreme, for there can be no question that Whitleyism has proved its efficacy in promoting harmony and security in the electricity supply industry at least.

One would readily agree that strife of any kind is regrettable, just as wars between nations of mankind are regrettable, but it is doubtful whether even strife should be avoided at the price of honour. The late war was entered into by Britain because of the violation of a solemn agreement, and very few in this country questioned the rightness of the nation's decision. In the case of Fulham, a corporation, in spite of all appeals and arguments, including a suggested reference to arbitration, in spite of the condemnation of the Ministry of Labour and of the employers' side of the District Joint Board (a deputation from which was refused a hearing), in spite of agreements and in face of warnings which might have suggested wiser counsels, obstinately persisted in remaining deaf to the dictates of prudence and honour. True, it began its secession from Whitley Councils in a non-trading department, and there are those who argue that the electricity department ought not to be made the cock-pit in which the troubles of other departments are fought out. This contention, however, will have to be argued out with the manual workers. The E.P.E.A. was satisfied that the employés of the Corporation in the various departments had done their utmost to bring the Corporation back to the Whitley Council, and that they had only decided to come out in sympathy after all other peaceable efforts had failed.

A great deal might be said on both sides of the question, but it is clear that the E.P.E.A. had nothing to do with the decision to involve the power station, but was merely faced with the choice of either assisting the Corporation or endeavouring to remain neutral, which it has been already stated is an impracticable attitude in view of the peculiar circumstances inseparable from a technical and supervisory staff. It may be stated, however, that it is not the policy of the Association to involve other departments when it is in trouble. But while that may be its own procedure, provided it is satisfied that every possible endeavour has been made to secure a peaceable settlement, it does not feel justified in frustrating the efforts of those who are out to secure the upholding of agreements. This policy cuts both ways, and it follows naturally as a corollary that had the *rôles* been reversed, and the employés been endeavouring to violate an agreement, the E.P.E.A. would have refused to be a party and would have thrown its weight on the side of the Corporation, and the staff would have done all in their power to maintain supply.

One wonders whether the critics have clearly realised what would have happened had the staff tried to keep the plant running, either by doing the work of the men who had withdrawn or by supervising imported labour. In the first place, they would have had to accept risks which are inevitable when an entire operative staff is new and of doubtful competence, and probably would have been kicked for their pains had anything untoward occurred. They would also have incurred the lasting hostility and suspicion of the workers and, worst of all, they would have placed themselves in a most unenviable moral position which would have had disastrous reactions throughout the country. Successful withdrawal from the non-trading Whitley Council would have been followed by a similar withdrawal from others, terminating, of course, eventually in the Electricity Department.

After they had assisted the Corporation to smash an agreement in the non-trading departments, what possible moral defence would the staff have possessed had they been threatened with a similar attack on the schedule of the N.J.B.? They would have fallen easy victims, and their defeat would have been signalised by the just scorn of the other employés, who would have been fairly entitled to say: "It serves you right."

Those who blame the E.P.E.A. are beginning at the wrong end. Let them empty the vials of their wrath on the real culprit. When they do that we shall probably hear less about broken agreements and threats to the supply industry.

It is astonishing how little censure an undertaking receives when it breaks its pledged word and how much criticism is bestowed upon the Association when it refuses to be a party to the action of that undertaking. In the eyes of many engineers, to break an agreement is a pardonable misdemeanour, but to cause the supply of electricity to be interrupted is a crime of the deepest dye. "Think of the moral effect"—say the critics—"of a shut-down," but who amongst them have ever casually remarked on the seven or eight interruptions of supply that have taken place recently at Halifax, consequent upon that Corporation having dismissed a competent staff! Where is the censure of the action of that municipality?

The ELECTRICAL REVIEW calls the action of the electricity employés at Fulham "altruism." Well, altruism is not a charge of which anyone need be unduly ashamed. "Bear ye one another's burden" was a precept spoken by a very great altruist. It is perhaps too much to claim that the sympathetic action of the staff was dictated solely by generous instincts—saints do not preponderate even amongst electrical engineers to a greater extent than they do in other walks of life—but the E.P.E.A. saw quite clearly that a principle was at stake and resolved—in the opinion of the writer rightly resolved—not to aid in its indefensible violation.

The E.P.E.A. was instrumental in shutting down the supply at Fulham, but in so doing it saved its soul. And it didn't get a medal for it, either!

It cannot help being noticed that the result of the action taken in this instance was that a settlement was speedily reached. Justice was done to the men who had lost their jobs, the Corporation was induced to adhere to its obligations, and peace was restored, not merely with regard to this municipality, but with regard to others. Had the Association attempted to keep a supply going, it would almost certainly have jeopardised the supply of other undertakings. One has little reason to doubt that the trouble would have spread to other London boroughs, and the process would have been repeated.

When dealing with such a case as this, one has not only to keep in mind the settlement of the immediate problem, but one has to determine one's action in the light of the effect it is likely to have on industrial relations in the future. If the action of the Association has clearly demonstrated that a corporation cannot look to the staff to pull it out of the mess into which it has landed itself by violation of agreements, it will have been justified.

In conclusion, the writer wishes to make it clear that,

though the opinions expressed above may appear startling to some of the readers of this journal, they are purely personal, and are put forward by him as an ordinary member of the E.P.E.A. in the hope of eliciting discussion. The Association's action has made it the target of criticism and, in the writer's opinion, it is only right that the whole matter should be properly ventilated.

Any attempt to solve a problem of this character is fraught with great difficulties, and only by a frank interchange of views from all who are concerned can the most satisfactory solution be arrived at.

New Italian Locomotives.

FIVE new electric locomotives, denominated "E.321," were to be put into regular service last week on the Milan-Varese third-rail line. They have been urgently wanted for some time, owing to the heavy traffic which passes this way night and morning, Varese being a residential town for the busy Milanese industrials.

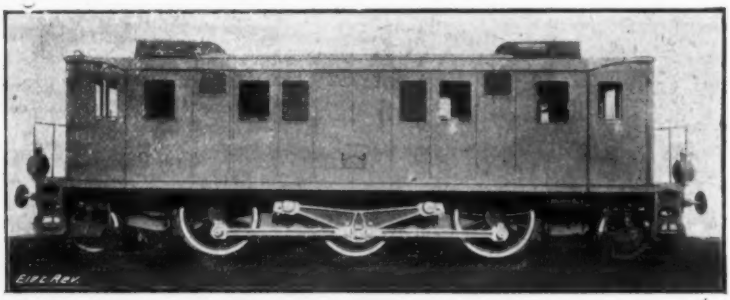


Fig. 1.—Brown-Boveri Locomotive, Type E 321.

The electrical characteristics of the locomotives are practically the same as those of the E.320 type, built by Messrs. Brown, Boveri & Co., in 1912, viz.: 650 volts, d.c., 2,000 h.p., two motors in series and parallel, and developing a speed of 90-100 kilometres per hour. Speed variation is obtained by coupling the motors in series and parallel, and by the reduction of the motor-field.

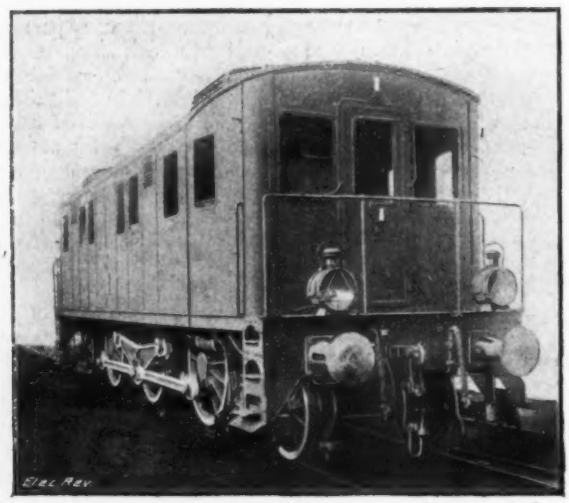


Fig. 2.—End View of Locomotive.

The improvement introduced—slight though it is—is one that has given most gratifying results during the trials, as the disagreeable vibrations, so marked in the E.320 model, have entirely disappeared. The change consists of a triangular connecting rod which has been substituted for the standard type, as is clearly shown in the illustrations. This system has already been tried with three-phase locomotives, but this is the first time that it has been introduced on third-rail, direct-current lines.

Five other electric locomotives should be ready very shortly on the E.321 model.

Workmen's Compensation Acts, 1906 & 1923.

By JOS. J. H. STANSFIELD.

THE Workmen's Compensation Acts of 1906 (Sections 2 and 8) and 1923 (Section 10) prescribe that a summary of the requirements of the Act with regard to the giving of notices of accident and the making of claims and the procedure to be followed in cases of industrial disease shall be kept constantly posted up in some conspicuous place where it may conveniently be read by the persons employed at or near every factory, workshop or other works or premises to which any of the provisions of the Factory and Workshop Acts apply.

Specimen copies of the summary amended to meet the requirements of the Act of 1923 have been generally issued on a reduced scale, and copies of the prescribed poster size may be obtained, price 1d. (by post 1½d. net), through any bookseller or directly from H.M. Stationery Office at the following addresses:—Imperial House, Kingsway, London, W.C.2, and 28, Abingdon Street, London, S.W.1; York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; or 120, George Street, Edinburgh. The form is numbered 84.

Accident Books (Form 85) may also be obtained from the same address, price 3d. or 6d. net (by post 3½d. or 7½d. net).

If the two forms are not kept as required, the occupier of the factory or workshop or other works or premises to which the Acts apply will be liable on summary conviction to a fine.

The new Act requires provision to be made in all factories for first-aid and ambulance similar to those already required in many classes of factories by Welfare Orders issued under the Police, Factories, &c. (Miscellaneous Provisions) Act of 1916.

In future a first-aid box or cupboard of a prescribed standard must be provided, and where more than 150 persons are employed, an additional box is required for every additional 150 persons or fractions of that number.

A letter has been issued by the Home Office in which the prescribed standard box or cupboard and contents is stated, a distinction being made in the requirements for factories employing 50 persons or less and those employing more than 50 persons. The contents of the box or cupboard must include a copy of the first-aid leaflet (Form 923) issued by the Factory Department of the Home Office.

Amongst the Forms obtained, it will be well also to obtain Form 892, which gives particulars of pamphlets on safety and welfare, which are on sale. These include the following of particular interest to the electrical industry:—

1. Fencing and safety precautions for transmission machinery in factories.
2. Protection of hoists.
3. Use of chains and other lifting gear.
7. Use of abrasive wheels.
8. Use of woodworking machinery. (In the press.)
9. Fencing and other safety precautions for power presses. (In the press.)

In addition, there are many memoranda and reports of interest, such as Electricity Regulations (Factory Form 928, reprinted 1922) Safety Committees, Messrooms and Canteens (Pamphlet No. 2), Ventilation, Lighting (Pamphlet No. 7), &c.

A large number of reports of the Industrial Fatigue Research Board of the Medical Research Council can also be obtained, and are well worth perusal.

The Electrical Contractors' Association (Inc.).

Annual Dinner.

ON Tuesday, January 15th, the annual dinner of the Electrical Contractors' Association (Inc.), the N.E.C.T.A., Ltd., and the National Federated Electrical Association was held at the Hotel Cecil, London. Mr. Robert Robson, M.I.E.E., the president, occupied the chair, and the attendance numbered about 160 guests and members.

After the loyal toast, Sir JAMES L. DEVONSHIRE, K.B.E., proposed the toast: "The Allied Associations and Honorary Officials," quoting effectively from the Association's Yearbook, with the contents of which he was much impressed. Referring to the unsuccessful efforts of the Association to prevent the grant of trading powers to muhicipal undertakers, he said that the success of the industry depended upon the existence of a prosperous body of retailers, and the success of the Association was largely due to the clauses which had been inserted in Bills at its instance.

As chairman of the National Trade Advisory Committee, Sir James said he was greatly indebted to the untiring labours of the secretary, Mr. L. G. Tate, as well as to the vice-president, Mr. J. Rowan.

Responding, Mr. ROBSON said he had the "Association spirit," and would like to see it instilled into every member of the Association and of allied associations; with enthusiasm in all the members anything could be accomplished. It was the duty of the Association to educate the public in the use of electricity and to bring electrical apparatus to the notice of the public, in the members' own show-rooms, not other people's show-rooms. Manufacturers did not really wish to open show-rooms—they did so only because the members of the Association did not possess sufficient show-rooms. The electrical industry was only touching the fringe of the developments that were possible—there was tremendous scope for it. This was the "Empire year," marked by the Wembley Exhibition, which would be of the greatest benefit to the members of the Association, the Council of which had that day resolved that they be urged to advocate the use of British-made material and to induce other sections of the industry to do likewise. The Association had in hand a memorandum for the guidance of members in dealing with supply authorities, which would be published in a few months. The first thing was to get on good terms with the supply authorities; the branches should invite central-station engineers to meet them and discuss measures for electrical development. Let them be persuasive and friendly, and do away with friction. If they developed a big demand for electricity, the suppliers would be too busy meeting it to go in for wiring. Where the suppliers were stubborn, they should secure the election of members of the Association on the councils and stop municipal trading by that means. The Association's "Trading Policy" was an excellent piece of work; he wished the other sections of the industry would bring out similar schemes. Voluntary registration of contractors would come into operation in a week or two. The wide variations in estimating had been commented on in the technical Press; a committee was considering the subject, not with a view to forming a price ring, but to educate members to abandon the system of quoting so much per point. Good work had been done by the Association in connection with the training of apprentices, and the Electrical Trades Benevolent Institution was always supported by the Association.

Mr. Robson then, in the name of the members, presented to Mr. H. Marryat a suite of furniture, with a diamond star for Mrs. Marryat, in recognition of his excellent work as Editor of *The Electrical Contractor* for 21 years.

Mr. MARRYAT, responding, urged that anything he had done for the Association had been fully repaid by the benefits which he had derived from his connection with it.

Mr. W. R. RAWLINGS proposed "The Guests," specially thanking Sir John Snell for refraining from granting to the municipal authorities full powers to undertake contractors' work, and Mr. C. H. Wordingham, C.B.E., for his help in establishing the National Register.

Responding, Sir JOHN SNELL said that electrical contractors need not be downhearted; the results of surveys made by supply engineers locally showed that within the next 10 years the present output of electrical energy would be nearly trebled. Last year the actual sales were 4,700 million kWh, and the total output for public utilities was 6,700 millions. Since their appointment the Electricity Commissioners had dealt with 1,700 applications for loan sanctions, representing 44 million pounds; that must have meant a good deal of work for contractors. The most "live" industry in the country to-day was the electrical industry. A great impetus had been given to it by the Institution of Electrical Engigineers, especially during the presidencies of Dr. Ferranti and Mr. Wordingham. He put forward a plea on behalf of the smaller class of premises and of the rural districts; with the growth of railway electrification, which was inevitable, and the development of the electricity districts, electrical supply would become available to distant townships and isolated establishments, adding to the amenities of the country and checking the flow of population to the cities.

Dr. ALEX. RUSSELL, Pres. I.E.E., also responding, expressed his high opinion of the ability and judgment of Mr. Rawlings as a member of the I.E.E. Council, and said that the status of the contractor never stood higher than it did now, owing to the high standard of workmanship and materials that he employed. He thanked the Association for its co-operation with the Wiring Rules Committee of the I.E.E. and with the Engineering Standards Association.

Mr. H. MARRYAT proposed "The Electrical Development Association," whose work was approved by every section of the industry. At one time it was thought that E.D.A. was only an extension of one's individual advertising costs, but now it was realised that it was doing work which no individual could do. E.D.A. appealed directly to the public, preparing the ground for individual advertising, and always had new schemes afoot.

Mr. W. B. WOODHOUSE, Pres. E.D.A., replied, stating that E.D.A. at Wembley was doing work for the whole industry, and he was glad that the contractors were going to help in producing that great exhibit. The prosperity which had reached other sections of the industry would in the near future reach the contractors. The supply undertakings would welcome the proposal of the president that they should meet contractors and discuss with them the use of domestic appliances, hiring, maintenance, showrooms, &c. The good feeling and harmony engendered by E.D.A. was just as valuable as its efficient advertising campaign, and Mr. Beauchamp was the man to bring about effective co-operation at the earliest possible moment.

Mr. H. T. YOUNG (in the absence of Mr. Cross, through illness) proposed the health of the chairman, expressing the hope that Mr. Robson would broadcast the "Association spirit" to the whole of the industry; he had done a great deal to help on the registration scheme, to which the contractors looked for salvation.

Mr. ROBSON, in reply, said he had travelled 100,000 miles on the work of the Association with Mr. Cross, than whom they had no better member. They were said to be a rough lot in the North, but they had produced some great electrical engineers—Swan, Parsons, Holmes, Merz, and others—and they had the largest supply undertaking in Europe, with which the contractors were on excellent terms. The Newcastle Corporation was not addicted to municipal trading. He advocated greater sociability, and pointed to the success of the E.T.B.I. annual ball at Newcastle. Lastly, he eulogised, amid applause, the work of the excellent secretary, Mr. L. G. Tate, who afterwards proposed a vote of thanks to the artistes for the musical entertainment, which had greatly contributed to the success of the evening.

An Electrically-Controlled Bridge.—In order to permit more free development of the growing shipbuilding industry on the River Cart, Renfrewshire, the old Inchinnan cast-iron swing-bridge has been replaced by a modern steel structure with a lifting span. The new bridge is of the rim bascule type, and was built and erected by Sir William Arrol and Company, Ltd., Glasgow. The control gear for its electric operation was designed and manufactured by the Igranic Electric Company, and is a typical example of what can be done by electric control even in the hands of unskilled labour. The operation of the bridge is extremely simple and foolproof. Two 50-h.p. motors are provided for lifting, each with a separate controller electrically interlocked with the other, and controlled by a single master switch. The sequence of operations is as follows:—The traffic gates are closed and automatically locked, the bridge bolt is withdrawn by a small motor (which is automatically stopped by a limit switch), and the lifting motors are started by a further movement of the master switch. These motors then accelerate, raising the bridge at a high speed till the end of the travel is approached, when they are slowed down and finally stopped by a screw limit switch. The operator has at all times full control, and can stop or reverse operations at any moment. A luminous indicator shows the position of the bridge, so that even in the thickest fog or at night the operator knows what is happening. Independent auxiliary hand gear is provided for emergency control, while if either motor should fail it can be cut out at the master switch and the bridge operated by the other power unit.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Small Turbo-Generator.

A small, non-condensing, steam turbo-generator lighting set (fig. 1) of unusual simplicity and strength has been developed recently by the WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., Pittsburgh, U.S.A., for use in oil well rigs, steam shovels, isolated pumping plants, and general outdoor construction work. It is equally applicable for service on yachts and small craft, for the generator coils are specially impregnated and other parts needing protection are heavily sherardised.

The unit, which is capable of generating 1.5 kW at 115 V d.c., consists of a single wheel, of the Westinghouse impulse, re-entry type, and a specially designed generator. It has only five castings and five moving parts. The moving parts are the shaft carrying the generator armature and turbine rotor, two governor weights, the governor spindle, and the valve stem. The outfit requires no bedplate or foundations, the whole set being supported by feet on the middle casting,

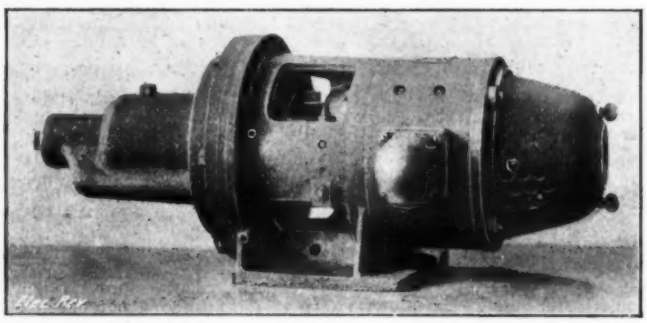


Fig. 1.—A Small Turbo-Generator.

which contains the generator inboard bearing. These feet can be secured to any substantial horizontal support with four small bolts. In the design of the unit provision is made against accidental overspeeding. When the speed exceeds a predetermined limit the rotor flange of the turbine expands and fills the clearance space in the cylinder. This establishes a rubbing contact, which acts as a brake and restrains the speed within a safe limit. The turbine and generator ends of the unit are completely isolated to ensure against the possibility of short-circuiting the windings due to steam or water entering the generator end. The turbine rotor, a solid forging, is of a distinctive design in that the buckets are milled on the inside periphery of an overhanging flange, which is integral with the disk proper. This design eliminates the difficulties arising from the use of built-up rotors and inserted or fastened blades. The steam nozzle and reversing chamber are die-cast in a single block of a special bronze alloy, which is bolted to the inside of the turbine cylinder. The steam passes from the buckets to the reversing chamber, where its direction is reversed and where it is redirected on the buckets. It then passes from the buckets to the exhaust. This arrangement insures the most effective use of the energy contained in the steam and the maximum obtainable efficiency from a unit of this size.

The speed is regulated by a fly-ball, centrifugal, shaft-type governor, which is carried in a heavy case bolted directly to the rotor disk. The governor valve is of the double-seated, balanced, poppet type. The valve and cage are made of a special bronze alloy to withstand the erosive and corrosive action of the steam. The escape of steam around the rotor shaft, where it passes through the cylinder, is prevented by an effective gland of the labyrinth type, employing piston-type, metal-sealing rings. The generator consists of a forged-steel frame ring, two cast-iron brackets, and the usual internal construction as to field, armature and brush rigging. The commutator end is provided with a protective, drip-proof, pressed-steel cover, which is held in place by two wing screws. The field windings of the generator have the shunt and series windings wound together as one coil, but inside the coil itself the two windings are entirely separate and thoroughly insulated from each other. A ventilating fan is mounted on the shaft outside of the rear bearing between the turbine and generator.

The armature laminations are pressed on a knurled portion of the shaft. The armature windings are wound directly into partially-closed slots. This construction results in a smaller diameter, with consequently greater strength and better balance than can be obtained with the spider and removable-armature design.

The complete set is 32⅝ in. long, 14¼ in. wide, and 12⅝ in. high. Its net weight is 250 lb.

The "Hogarth" Four-Valve Receiver.

MESSRS. INTERNATIONAL MOTORS, LTD., of Bloemfontein Avenue, Shepherd's Bush, W., have recently put on the market a four-valve receiver, fig. 2, consisting of one h.f. amplifier, one detector, and two l.f. amplifiers. The h.f. and the detector valves have separate filament resistances, but the two l.f. amplifiers have one filament resistance operating the two valves. The aerial tuning circuit is loose-coupled to the receiver by means of a 180-degree vario-coupler, which is wound with No. 22 d.c.c. wire on threaded ebonite formers, which allow the turns to be spaced and pile wound, thus reducing the self capacity to a minimum. The primary coil is tapped at nine points for tuning the aerial, and the secondary coil is tuned by a .001 mF condenser. The h.f. amplifier is of the tuned-anode type, and reactance is coupled to it by means of another 180-degree vario-coupler similar to the one used for the aerial tuning. This, however, is tuned by a .0003 mF condenser. The stator of this

Fig. 2.—The "Hogarth" Four-Valve Receiver.

vario-coupler is the anode coil and the rotor provides the reaction. The condensers are of the "Polar" type and the transformers of "Silvertown" manufacture. The only terminals visible on the front of the apparatus are those for the telephones or the loud speaker. The battery connections, earth and aerial, are fitted at the back of the case. The selector switch of the aerial tuning coil when in its zero position connects the earth and aerial together. All the connections inside the receiver are of heavy-gauge copper and all joints are soldered. The connections of the rotors in the vario-couplers are of the pig-tail type and do not depend on friction. The selector switches of the aerial tuning inductance and the anode coil are placed in an approximate position, and the reaction dial is placed at the full position, and then the condenser knobs are turned until a faint whistle is heard. The reaction coupling is then loosened until speech or music is heard, and a very slight adjustment of the condensers will bring the volume of the signals up to loud-speaker strength. A 100-V h.p. battery is used with this set, 50 V being used across the first l.f. amplifier and about 90 V across the second. The chief claim which is made for this set is that signals, when properly adjusted, are distortionless, and that the set is extremely selective.

A New Type of Bonding Clip.

The clip illustrated in fig. 3 was originally designed for clamping rubber hose to a standpipe or other metal tubing, and it performs its function well. Its extension to electrical

Fig. 3.—A New Bonding Clip.

work is a natural development, for it possesses many points which make it eminently suitable for bonding and similar work. It consists of a mild steel band into which is cut the female portion of a square thread (about 16 to the inch). Upon one end of this band a saddle is firmly keyed and

through the saddle runs a square-threaded screw with a washer under its head and a retaining piece at the other end. The head is of ample proportions but just clears the band, while the slot is unusually wide and unlikely to break out. The band is not soft but has sufficient "give" in it to take up the shape of any object to which it is applied. On this account it is adaptable to the clamping of armour wires on cables. In this application bonding to the wires of the opposite cable in a joint box is simply and satisfactorily effected by inserting a copper strip beneath the band before tightening it up with a screwdriver. The clip can, of course, be applied to the bonding of groups of conduit, although for this purpose the soft copper strip usually supplied as a part of standard wiring systems is as effective and cheaper.

The clip is made by MESSRS. L. ROBINSON & Co., London Chambers, Gillingham, Kent.

Device for Preventing "Chattering" in a Switch.

A correspondent says that some time ago, having to design an electrically-operated switch for use in conjunction with a time switch for street lighting with alternating current, he found that the armature caused a considerable amount of noise when the switch was in the "on" position, due to vibration against the pole face. He tried various pads between the armature and pole face, such as a brass button, leather, rubber, &c., in order, if possible, to obtain silent working, but with no great success. Finally he adopted the method shown in the sketch (fig. 4) which answered perfectly. The

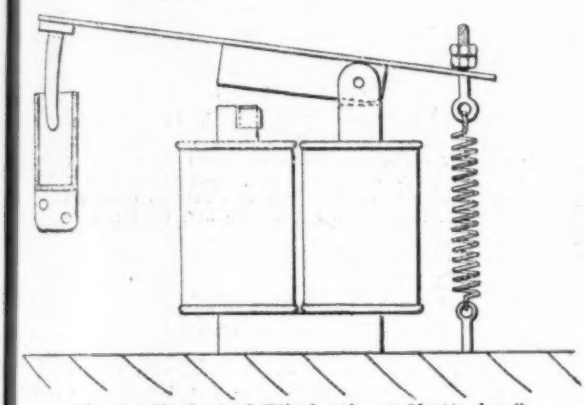


Fig. 4.—Method of Eliminating "Chattering."

pole of the magnet has a saw cut run down the centre for approximately half an inch, and into the slot so formed there is inserted a short-circuited brass band, which creates a flux in the pole tip out of phase with the main flux and thus does away with the dead point when the main flux is passing through zero. The watts absorbed by the coil are, of course, increased by a small amount, but this was considered unimportant compared with silence when in use.

Parliamentary.

[From Our Special Parliamentary Correspondent.]

Broadcasting Licences.

On January 17th, Captain KING, replying for the Postmaster-General, informed Sir H. Brittain that the total number of wireless reception licences issued up to the end of December last was approximately 585,000, of which about 58,000 were experimental licences and 527,000 licences for broadcast reception. Of the latter, about 65,000 were due to be renewed before the middle of January, and he could not yet state how many of these had actually been renewed. During the last three months of 1923 approximately 405,000 licences for broadcast reception were issued. The total number of experimental licences remained practically unchanged.

Science in Industry.

During the debate on the Labour vote of censure on the Government, on January 17th, Mr. FRANK HODGES, the miners' leader, urged that, instead of lowering the cost of production by lowering wages, industry should seek to reduce costs by the application of the scientific mind to natural resources. He instanced America as a case in point, and said that Mr. Gompers, the leader of the American labour movement, had informed him that the first World Power Conference was to be held in London this year, and, so much had the industrial mind of America got hold of the question of the utilisation of electrical energy to bring down the cost of production rather than through low wages, that Mr. Gompers had made representations to the American Government that six leaders of the American trade union movement should come to London to attend the Conference in order to study the implication of large power stations with the unlimited use of electricity in the social and industrial life of the workers. What, asked Mr. Hodges, was the position in this country? We were limited, geographically, but we were densely populated. It was true that the political order of the world had been upset, and that our old trade connections had been broken up, and it was equally true that it was the business of statesmanship to repair that damage as speedily as possible. Nevertheless, within our own country there had been opportunities for reducing misery which the Government had not seized. We had not the unlimited water supplies of America, but we had practically unlimited coal supplies. The modern scientific mind said: "Why not utilise scientifically the coal that is produced in this country in order that electrical energy may be generated and power supplied in bulk at cheap prices, in order that, with their limited purchasing power, the workers can have a larger measure of our national productivity?" He went further, and he said that not only were the present electrical arrangements of our country a disgrace to any Government, but they were so far removed from the declarations and opinions of scientific men as to make one wonder why the Government did not take into consultation the scientists of the country and ask them how our natural resources could be utilised to the best advantage without having to press the common people down into greater depths of misery. He hoped that a Labour Government would regard the scientific organisation of industry as a prime political effort.

Railways in North London.

Mr. ROBERT MORRISON asked the Parliamentary Secretary to the Ministry of Transport whether he had received requests from a number of local authorities in North London asking that pressure should be brought to bear by the Government upon the railway companies concerned to secure the extension northwards of the tube at Finsbury Park; and whether he had taken any action in the matter.

Lieut.-Colonel MOORE-BRABAZON said he had received several resolutions from local authorities to the effect stated, and he had been in communication with the railway companies concerned in the matter. None of these companies had put forward any scheme for the extension of the existing tube railway northwards from Finsbury Park, but they were giving close attention to the question of improving railway facilities in the area, and the early electrification of certain lines was in contemplation.

Empire Radio Communication.

On January 21st, in reply to Mr. Ammon, Sir L. WORTHINGTON-EVANS, Postmaster-General, said that no agreement had been arrived at between the Post Office and the Marconi Co. respecting Empire radio communication; it had been his intention that any such agreement should be subject to ratification by the House of Commons.

The Jamming of Ships' Distress Signals.

On January 21st, in reply to Captain Berkeley, Sir L. WORTHINGTON-EVANS said that there was no record or recollection of any case of interference with S.O.S. signals by broadcast programmes. If the hon. member referred to the French vessel *Député Emile Driant*, which was wrecked off the French coast on August 30th, the inquiry made had shown that the first distress call was received at 4.54 a.m., and the last signals at 5.15 a.m., when the ship's apparatus failed. No British broadcasting station was working at the time.

The Labour Amendment.

The Vote on the Labour amendment to the Address in reply to the Speech from the Throne—"That your Majesty's present advisers have not the confidence of this House"—was taken shortly after eleven o'clock on Monday night. The figures were announced as follows:—For the amendment, 328; against, 256; majority, 72.

Curative Powers of Electricity.—A book just published by a Swiss scientist, Mr. E. K. Mueller, of Zurich, whose investigations have greatly contributed to elucidating the action of electricity on the human body, draws attention to the fact that the body is itself traversed by a complicated system of electric currents, which, flowing up and down intricate paths, attend the vital functions of the organism, so that the application of electric currents from outside, if improperly controlled, is apt to interfere with the life-giving currents and thus to counteract the desired curative effect. This risk is definitely avoided by the new electro-therapeutic method developed by Mr. Mueller, which, briefly summarised, could be described as follows: Instead of using electrodes having a considerable contact surface, "edge"-electrodes are employed which come in contact with the skin along what is practically equivalent to a mere contact line, the anode and cathode being separated by a fraction of a millimetre, so that the current, immediately after entering the skin, is caused to leave it, without any risk of straying off towards the interior. By moving this pair of electrodes up and down the skin, any portion desired can be submitted to the treatment, and some sort of electrostatic suction is added to the immediate pricking effect of the current thus applied. Remarkable results are said to have been obtained in soothing the nerves and allaying pain.—*Scientific American.*

Correspondence.

Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Transformers for Very High Voltage Tests.

A sentence in the article under the above heading in the current number of the ELECTRICAL REVIEW appears to invite comment and correction.

It is stated that a manufacturing firm is now making a number of high-voltage testing transformers aggregating two million volts. This statement must surely have crept into the article in error, as its inference may be so misleading as to be only worthy of a certain section of the daily lay Press.

The figure is apparently arrived at by taking the arithmetical sum of the voltages of the transformers under construction, and if this is to be taken as the dimensions of an undertaking, please will you note that the writer is well acquainted with a direct-current distribution system having an aggregate voltage of well over two million volts—*i.e.*, some 10,000 lamps each of 230 volts. If anything is necessary, this statement shows the absurdity of such a method of calculation.

Your attention is drawn to the point, as it seems a pity that the technical Press should be the means of publishing statements that can easily be held up by competitors of the industry as "fairy tales."

10⁵.

January 12th, 1924.

[We venture to differ from our correspondent. Just as accumulators, which are designed for storage, are rated by the number of ampere-hours (*i.e.*, quantity of electricity) that they will store, and boilers by the number of pounds of water that they can evaporate per hour, so transformers for power purposes are rated by the kilowatts that they can transmit, and transformers designed for testing by the pressure that they can give. In each case the fundamental characteristic is properly used for terse description. The fundamental characteristic of lamps is not their voltage, but the flux of light that they give; to speak of 10,000 lamps as aggregating, say, 500,000 candle-power, would be correct in form, but to say that they aggregate two million volts is nonsense.—EDS. ELEC. REV.]

Two-way Pendant-switch Flexibles.

During the recent damp weather we have had occasion to remedy several faults due to "shorting" and subsequent ignition of 2-way pendant-switch flexibles.

The trouble appears to arise from the inability to obtain machine-twisted 3-core flexible. Hence it is necessary to braid a third core into ordinary twin flex, which naturally tightens the twist and precludes ventilation, leading to a breakdown in damp weather. Owing to the size of a twisted three-core d.v. flex it is preferable to use s.v. flex. It may be added that in no case has s.v. *twin* flex broken down, though the proportion used is twenty to one.

The fault invariably takes place midway in the hanging cord where the twist would be the tightest, and not where the cord is subject to wear.

We should be glad if we could so far trespass upon your space with a view to interesting manufacturers in resuming the manufacture of a suitable flexible, or, better still, a two-way ceiling switch with ratchet action which will do away with pendant live switch-wires.

Safety First.

January 14th, 1924.

The Status of the Electrician.

Could you allot a small space in your correspondence columns for a few remarks as to our status as electricians, and what we shall encounter a little later on unless we realise our position? We used to be an essential element in many branches of industry, but owing to the sectionising of our calling we are now as cheap as dirt, and these sections are producing a great overcrowding which makes the electrician of pre-war quality begin to think of some way of alleviation. I fully realise that there are many REVIEW readers, old-timers in the electrical ranks, who had to know their work, besides the others, younger and qualified electricians, &c. Now, my views relate to what an electrician used to be and ought to be, but cannot be. The word "electrician" should mean a person who thoroughly understands the science and application of electricity in all its branches. He ought to be so, because he could let his employer see what electricity is to him and what a vast field it has to offer. Where is a greater gift of nature than electricity? And yet I feel ashamed to say I am an electrician, because I find that the rank and file of us are considered as of no importance, and that four years is an excessive time to learn electrical engineering. Here are a few remarks passed from time to time by certain people, viz.:—"Oh, I thought you could become an electrician in a very short time; I can't see much in it, as boys do lighting and power work." Another remark, perhaps heard by other readers, is: "Oh, I can get lighting done at twelve-and-six a point; why pay more to contractors when the chap next door is an electrical engineer? He was a window-cleaner at one time, and he will give me better service than a contractor, for they know how to charge and twist." These are only a few of the many hurtful remarks, and my idea of writing is to get, or hope to get, a better future for all qualified electricians, as we are being sectioned and outdone by those who run electrical work as a side line. In my opinion the electrical line offers a trade for anybody to have a try at, for I have known men who have worked as labourers a short time and then got jobs as fully qualified electricians. Very nice too! Who's to blame? The wireless line is full of this sort of people, and then some wonder why sets of lacquer, paint, varnish, and doped apparatus cannot be sold. I say employ an electrician who knows his calling, and we shall have a profession worth calling one; and what you discover in electrical research or radio phenomena keep within the electrical profession and don't broadcast it. Doctors don't sell their intellect to the public at large; they have a sort of mutual interest among themselves. I should very much like our electrical men to follow a similar course. By the way, I saw an advertisement in a paper thus: "Electrician *or* improver to run works' plant." A box number was given, and the pay was 30s. per week. He must be a lighting and power man. Fancy running a works' plant with such!

Disgusted.

January 1st, 1924.

Delayed Delivery.

Abler pens than mine draw attention to what, in my humble opinion, is largely responsible for unemployment. Before the war I was engaged in electrical installation work, and on any day in two hours frequently secured over the counter and put on rail materials and fittings that it takes anything up to four months to secure and then never complete.

A walk down Queen Victoria Street and Upper Thames Street any morning, and one could take a quiet lunch after securing everything complete, fixing screws neatly attached to each fitting finished to match, and all those details that make a job, instead of as nowadays merely a humbugging mess up.

After lunch, a walk to the station found your goods already in the train, and before dark that job was progressing. Having experienced this business-like method for 16 years, my attempt, since war service, to take it up again is proving a veritable nightmare.

Before the war any current number of the ELECTRICAL REVIEW was all that was necessary to price and secure a contract with. With but few exceptions prices are studiously omitted and to merely get that preliminary item takes a week or more, but at long intervals you can find an indulgent prospective customer who does not think you are daft when you have to say: "Well, sir, I should very much like to undertake your job, but I don't know in the least what it will cost, whether you will get what you want, or when." Assuming his amazing indulgence, you make a commencement; spend a fortune on stamps; catalogues announced as being ready last October twelvemonth have only just come to hand; prices omitted in many cases, and therefore merely additions to the waste paper heap. Such a catalogue you present to your customer to select fittings from. A range is carefully selected and a visit arranged to the nearest show room—pictures of ye olden days come to mind. As far as most of us are concerned who are not war profiteers, no railway service exists, and therefore the monthly so-called excursion to the nearest provincial town provides the only date upon which business can be done in town. Arriving there, your troubles begin. Before ten o'clock you can rarely find anyone except office cleaners and caretakers. If you should fail to wait, lunch time, when you call back, finds possibly a little boy in knickers or a girl typist. If you then decide to go somewhere else till any responsible party returns, dinner time arrives, and until 2 o'clock business premises are like forsaken cities. Bustle only commences at four for home. Assuming you are lucky and catch a swaggerer strolling back with a gold-tipped fag, you are ignored until he undresses, and then it's: "Well, what do *you* want?"

Having had no catalogue, you ask to see what you otherwise could have ordered by post.

"Oh, *we* don't keep any stock here; our stock is so-and-so." Well, you stifle a very small word and go out. Making your way to the trade department, you eventually find a basement entrance, with a trade counter exactly one yard square.

Having no order numbers, never having seen a single item of an order that, to be of any value to you, must be complete, you produce your list. At the very first item you get told: "Oh! Mr. Nowheretobefound looks after them," and before you have mentioned three more items, all of which you are told are not now stocked, you fling out, and on the pavement may possibly be taken for an escaped lunatic.

If you secure a few parcels you find everyone leaving the premises, and finally you are left as best as you can to get

what may or may not be, generally *is* not, what you ordered, and never complete. A taxi expense gets you to the station and here your parcels are spotted, run off to the weighing machine, and three times your fare is charged for your purchases, which already you wish at the bottom of the deep blue sea.

It would be invidious for you to name these firms, but this has been my experience since last March.

One company failed to let me have catalogues advertised; another did send theirs, but their stock has no association with their catalogue numbers.

My customer called, selected a range of fittings, and was promised those actually selected. That was in May. October came and then all had not arrived. All correspondence was deliberately ignored; piffling questions and regrets substituted; finally in despair the goods were cancelled, and with few exceptions secured elsewhere in a few days, mere stock items. Yet still the same failure to deliver common stock articles left the job unfinished, and I am now refused payment.

At one company's premises a schoolboy let me wander all over their deserted offices, opening cupboards, turning over papers on roll top desks, in an attempt to secure catalogues to make a selection for some £300 worth of stuff, for cash. All I could find were dated 1914 to 1920. Afterwards I found their *trade* (?) counter, 3 ft. x 3 ft., in a filthy basement, and failed to get anything.

Another company gave me, after extreme difficulty, the price of a 1-kW dynamo. One fortnight afterwards I received a quotation exactly double their verbally-given price; *but*, putting it quite beyond consideration. Approximately six weeks dispatch, six weeks—with a fortnight's foolery on our substitute for a railway service—leaves contract work impossible and the miserable shabby things that one eventually gets make one almost say: "The sooner German goods are on the market again the better."

You are flatly told to your face that items staring you in the face, piled up in bins, are out of stock, and unless you make yourself quite objectionable, you can get nothing; and when you come to letters addressed to you from managers of departments, blatant ignorance is sickening, gush and insincere regrets nauseating.

Another Disgusted Contractor.

[This letter has been considerably abbreviated. Our correspondent gave the names of the firms, which are all well-known.—EDS. ELEC. REV.]

Appointments Filled.

Of recent date an advertisement appeared in your journal with reference to an existing vacancy on the staff of Cheadle and Gatley electricity scheme. Doubtless many of your readers applied for this position and have a similar cause for complaint. The unsuccessful applicants were notified to that effect by means of an open typewritten circular, or, in other words, a post card.

I feel that such a lack of common courtesy reflects very much as to the nature of the position and I would offer deep sympathy to the successful applicant.

Trusting this may be accepted in the spirit meant.

Courteous.

January 16th, 1924.

Squirrel-cage Motors of Over 5 h.p.

Your correspondent this week, "Motor Sales Engineer," is entitled to our thanks for drawing attention to the irritating and arbitrary restrictions imposed by supply authorities against the use of s.c.r. motors. In the hope that a profitable discussion will develop, I would like to supplement the general case there put forward by giving particulars of local practice here.

The four large West Riding undertakings, each having approximately 50,000 kW to back their authority, treat the squirrel-cage two- and three-phase motor as follows:—

a. Frankly accommodating, happily unhampered by regulations, s.c.r. motors are connected *ad lib.* up to over 100 h.p.

b. Also accommodating, but with a blind eye on their regulations, which are somewhat similar to those of their neighbour *c*.

c. With meticulous interpretation of the law, their regulations allow 10 h.p., s.c.r. motors on two-phase and 25 h.p. on three-phase supply *provided* the starting current does not exeeed 1½ times full-load current, and fast and loose pulleys or clutches are used.

d. With retrograde repudiation of regulations in operation for nearly twenty years, which permitted *ad lib.* s.c.r. motors up to 15 h.p., and up to 3 h.p. these could be switched direct on. To-day slip-ring motors are arbitrarily insisted upon as low as 5 h.p., and starters are demanded even for "pup" motors.

I suggest, Mr. Editor, that these four cases are typical of the chaotic state of supply regulations all over the country, and illustrate the need for some clear thinking by the heads. The recent change of policy indicated in *d* is a significant reply to your correspondent's plea for progress, and yet, is it necessarily storing up trouble?

The bogey of starting current should be inquired into and not accepted at face value or as put forward by the mains or operating engineers, whose harassed minds are naturally unable to obtain a sense of proportion.

Finally, let it be stated again: the squirrel-cage motor, with star-delta starter, cheap, trouble-free, and ideal in every case where starting torque permits, should be looked upon by the chief engineer as his greatest asset, and not as a menace to his supply system.

Another Motor Salesman.

January 20th, 1924.

The letter "Squirrel-cage Motors over 5 h.p.," in your last issue causes me to point out another peculiarity of Corporation rules.

In those cases when they do permit squirrel-cage motors they often prohibit star-delta starters, and it is quite evident that there are a number of people who deal with electric motors, who are under the impression that a star-delta starter permits a greater initial current than an auto-transformer starter.

The effect on the line and on the motor is the same, whether a star-delta starter is used, or an auto-starter on a 0.6 tapping; if the latter is on a higher tapping the starting current is, of course, in excess of that which passes with a star-delta starter.

But this simple fact appears to be unknown to many corporation engineers, and not a few others as well.

Star-Delta.

January 21st, 1924.

Domestic Electrical Apparatus.

The opinion expressed in your leader of the 18th inst. is hardly fair to the electrical contracting industry.

I am a contractor, and some years ago equipped my house with many electrical appliances, but as the supply authorities restrict the use of current, it became necessary to install gas apparatus also—fortunately so, as it turns out, for gas makes an excellent stand-by, when the current fails, usually on Sunday mornings.

The charge for current is 7d. per unit for lighting and 3d. per unit for power, plus 36s. per annum for two meters. Should customers compare the 3s. per 1,000 for gas and the 9s. per annum for the meters, doubtless the suggested affable and helpful representative of the supply authority would be safer with a life preserver in his meagre tool kit.

The electrical installation has never given trouble, probably because we only carry out first-class work.

The domestic electrical appliance has received my closest attention, and if you challenged me to perform the work of the charlady, with the aid of an electric washer, it would not occasion me any concern, for we have carried out many tests, and statistics of some really wonderful washes carried out by us are available. I am sorry to say that the interest of the supply authorities' affable representative on several occasions has not extended beyond the trade discount, which he collects for doing nothing.

I am also one of the many contractors who invested money in a show-room, and in addition have given much time and thought to the subject, so I cannot appreciate your suggestion of indifference.

It is not the contractor's fault that better progress is not made, and therefore, as a ratepayer, he cannot be pleased with your suggestion of fresh competition from any municipal body, any more than the ratepayer who is not a contractor will find relief in high rates and dear current.

Cheap current only will develop the use of electricity and appliances, and just as readily as dear current has brought the apparatus into discredit, when compared with other methods.

A Northern Contractor.

January 21st, 1924.

[Will our correspondent kindly read our leader again? There was no reflection on the contractor in the suggestion that it would not pay him to institute a maintenance service; moreover, there was no reference to any "municipal body"; our point was that the supply authority should do what no one else does, and what no one else can do.—EDS ELEC. REV.]

The Cost of Living in India.

I noticed a letter in one of the issues of the ELECTRICAL REVIEW in which the writer asked the following question: "Would Rs. 500 per month keep a man and wife in average comfort in Bombay or Calcutta?"

Having lived in Bombay for the past six years, I have no hesitation in emphatically stating that a married man cannot exist in Bombay on Rs. 500 a month, much less live in average comfort.

The following are a few of the monthly items of expenditure in Bombay and Calcutta:—

Rent: Anything from Rs. 200 to Rs. 500 (average about Rs. 400).
Servants: Cook, Rs. 40; boy, Rs. 35; hamal, Rs. 25-30.
Food: Rs. 200.

These are the bare necessities, but there are other things that crop up monthly, such as dhobey (washer-man), conveyances, clubs, and occasionally (sometimes pretty regularly) doctors' bills.

No married man should come to a town in India on a salary of less than Rs. 1,000 per mensem, and even on that he will not be able to paint the town very red.

J. J. S.

Bombay, *December 29th*, 1923.

Calculating the Temperature of Electrically-heated Wires.

With reference to our communication published in the current edition of the ELECTRICAL REVIEW, under the heading "Calculating the Temperature of Electrically-heated Wires," we would inform you that the insertion "our" in the twelfth line of paragraph 3, is evidently a printer's error, as it did not appear in our communication. From the published interpretation of our communication, it would appear that we are the manufacturers of "Calido" and "Cekas" materials, which is not the case.

A. C. Scott & Co., Ltd.
A. C. SCOTT, *Managing Director.*

Manchester, *January 19th*, 1924.

A Libel on the Megger.

I, too, enjoyed Mr. Evershed's letter, especially the P.S. Dare one suggest he has a rather careful cook? If her scales on Wednesday show the old dry loaf to weigh 1 lb. 18 oz., *i.e.*, 1 oz. more than when new and moisture-laden on Monday, is not one entitled to conclude that something *is* wrong with the weighing machine? With his professional and domestic instruments producing the results he describes, Mr. Evershed's plight calls for all the sympathy one can muster.

Maybe, Mr. Editor—tell it not in Gath—the printer's devil knows of an explanation!

A. Morris.

Birmingham, *January 18th*, 1924.

[This time the printer is guiltless; he followed copy precisely.—EDS. ELEC. REV.]

I agree with Mr. Evershed that it is regrettable that instruments should be blamed for calling our attention to scientific facts which "are unexpected." Nevertheless, it is not altogether a bad mental attitude to be sceptical of all unexpected results.

For example, I am suspicious either of the consistency of Mr. Evershed's bread scale, or of his cook's observational powers.

My experience is that bread gets lighter as time goes on, but, behold! his "moisture-laden" loaf commenced by weighing 1 lb. 17 oz., and ended by weighing 2 lb. 2 oz. The relative humidity of Mr. Evershed's bread bin must be unnecessarily high (soaking in tea is a simpler method of adding moisture)—or else can it be that the cook has been trained to decimal measurements and is confused by sexadecimal divisions?

Llewelyn B. Atkinson.

London, *January 21st*, 1924.

P.S.—I have no cook just now, so am unable to repeat the experiment with the same complete apparatus.

The Quantum Theory.

Your correspondent, "Facts before Fancies," raises an interesting point when he suggests that light is a state or condition of his cerebral cortex due to an effect on his nerve endings. To my mind he is not sufficiently sweeping. Is not matter of a similar nature? What is the chair in which I sit but the state of my cerebral cortex due to stimulation of the nerve endings in a certain portion of my anatomy? Work I would define as a peculiarly unpleasant sensation.

On second thoughts it appears doubtful that we have any right to assume that the cerebral cortex itself has any objective reality.

In conclusion, may I thank your correspondent for his ingenious attempt to enliven the columns of that useful but somewhat staid figment of my imagination—the ELECTRICAL REVIEW?

Facts *are* Fancies.

While confessing my sins, I cannot help enjoying the humour of "Astonished"—who does not help us to define our terms.

You, Sir, can testify that nothing was farther from my thoughts than to attack in any way the original article of Mr. Western, to whom all your readers and I are deeply indebted; and, if "Astonished" will read my letters again—without jumping at wrong conclusions in his haste to misunderstand me—he may do something of practical value, and so add to our store of useful knowledge.

Facts Before Fancies.

January 19th, 1924.

Business Notes.

Bankruptcy Proceedings.—D. ROSE & Co., electrical engineers, 25, Osborn Street, E.—Receiving order made January 10th on creditor's petition. First meeting January 24th, public examination February 26th; both at Carey Street, W.C.

H. RHODES (Victoria Electrical Co.). kinema operator, 11, Ratcliffe Place, and Victoria Buildings, Keswick.—Receiving order made January 10th on debtor's own petition.

P. BUTLER (Eastern Electrical Engineering Co.), electrical engineer, late of 127, King Street, Great Yarmouth.—First meeting January 25th at the Official Receiver's office, 8, Upper King Street, Norwich; public examination February 22nd at the Town Hall, Great Yarmouth.

F. B. THORPE, electrical engineer, 1a, West Laithgate, Doncaster.—Last day for proofs for dividend February 2nd. Trustee, Mr. W. Emmerson, 99, Albion Street, Leeds.

H. W. SLATER (Engineering Supplies Co.), mechanical and electrical engineer, 54, Grey Street, Newcastle-on-Tyne.—First meeting January 29th at the Official Receiver's office, 4, Northumberland Street, Newcastle-upon-Tyne; public examination February 7th at the County Court, Newcastle-on-Tyne.

F. SMITH (F. Smith & Co.), wholesale electrical accessories factor, 6, Imperial Buildings, Dale End, Birmingham.—Trustee, Mr. C. T. Appleby, 26, Corporation Street, Birmingham, appointed January 16th.

B. BARNETT, electrical engineer, 104, Whitechapel Road, E.—Trustee, Mr. W. A. J. Osborne, 119, Finsbury Pavement, E.C., released November 27th, 1923.

H. TRUELOVE (H. Truelove & Co.), electrical engineer, 19, Shepley Street, Stalybridge.—Trustee, Mr. J. G. Gibson, Official Receiver, Byrom Street, Manchester, released December 13th, 1923.

R. A. DEPLEDGE (Scunthorpe Electrical Engineering Co.), electrical engineer, 53, Frodingham Road, Scunthorpe. Trustee, Mr. S. M. Forrester, 1, Town Hall Street, Grimsby, released November 22nd 1923.

C. CAMPBELL (C. T. Campbell), electrical engineer, the only known partner of Campbell & McDonald, electrical engineers, 6, St. James' Street, Glasgow.—Examination January 29th at County Buildings, 50, Wilson Street, Glasgow. Meeting of creditors at the chambers of Messrs. P. B. McCaig & Mitchell, 124, St. Vincent Street, Glasgow, on February 6th.

J. P. GIBB (Waterhouse & Gibb), wholesale electrical engineer, 5, Exchange Street, Dundee.—Examination January 24th at the Sheriff Court House, West Bell Street, Dundee. Meeting of creditors March 14th at the chambers of Messrs. Walter and W. B. Galbraith, 87, St. Vincent Street, Glasgow.

ALFRED HENRY MILNES, 48, Lidget Street, Lindley, Huddersfield, electrical engineer.—The public examination of this debtor was held on January 14th at the County Court House, Queen Street, Huddersfield. The statement of affairs showed gross liabilities of £561. Debtor attributed his failure to bad trade, shortness of capital, and keen competition. The examination was closed.

With reference to the proceedings in bankruptcy relating to the Engineering Supplies Company, of Newcastle-on-Tyne (see ELEC. REV., January 18th, p. 94), Messrs. ENGINEERING SUPPLIES, LTD., of 155a, Upper Thames Street, E.C.4, ask us to state that they have no connection with that firm.

Company Liquidations.—SIMMONDS BROTHERS, LTD., Newton Street, Holborn, London, W.C., and at Wandsworth, London, S.W., electrical engineers, &c.—A meeting of the creditors of the above firm was held on January 16th at the Institute of Chartered Accountants, Moorgate Place, E.C. The chair was occupied by Sir Harold de Courcy Moore, C.A., of Messrs. Moore, Stephens & Co., 2, Gresham Buildings, E.C., who had been appointed to act as the receiver for the debenture holders in the company and as the liquidator in the voluntary winding-up.

The chairman stated that, although there were something like 150 creditors, only a small percentage had attended that meeting, as a rumour had gained currency that there was likely to be a distribution of something like 20s. in the £. The debenture holders were the bank, and they appointed him as receiver on November 3rd. The position of the company had materially improved since his appointment, due mainly to the fact that a lease of certain premises in Newton Street, which were originally valued in the books at approximately £6,000, had been sold by him for £12,000. The case was one of the few where the appointment of a receiver had not only protected the interests of the debenture holders, but had improved the prospects of the creditors. Proceeding, the chairman submitted a statement of affairs which showed liabilities to unsecured creditors of £11,515. The assets were

estimated to realise £30,523, from which had to be deducted £1,894 in respect of the receiver's costs, £649 for preferential claims, and £11,832 due on debentures. The net assets, therefore, were £16,147, and the estate thus showed a surplus so far as the creditors were concerned. The assets consisted of: Cash at bank and in hand, £745; stock and equipment of furnishing department, estimated to realise £5,000; electrical business at Wandsworth, £6,243; lease of Newton Street premises, £12,000; and good book debts, £6,535. The electrical business at Wandsworth included certain freehold premises, stock and plant, which he had agreed to sell subject to the approval of the shareholders, for £7,000. There was a charge on the freehold of £756, leaving the figure of £6,243 mentioned in the statement of affairs. The assets had been practically liquidated, with the exception of the furnishing department stock, but negotiations were proceeding for a sale. Subject to the costs of the receivership and liquidation, there appeared to be a surplus, and he expected within a comparatively short time to be able to send a very substantial dividend to the creditors, which should not be less than 20s. in the £. In his capacity as receiver he had continued to deal with the existing creditors.

Mr. HOUSTOUN said there was every prospect of a most satisfactory realisation, and the creditors looked like being paid in full. He proposed a resolution confirming the voluntary liquidation of the company, with Sir Harold de Courcy Moore as liquidator. The representative of Messrs. A. V. Humphries seconded the motion, which was carried unanimously. The following are creditors herein:—

	£		£
Avon India Rubber Co.	50	McKechnie Bros., Ltd.	133
Boss & Boss, Ltd.	258	McNamara & Co., Ltd.	110
W. Board	51	Metropolitan-Vickers Electrical Co., Ltd.	58
Cole, Loasby & Co., Ltd. ...	236	E. A. Mills	56
Dorman & Smith	132	Moore, Stephens & Co.	147
Engineering and National Employés' Federation	64	Saxonia Electric Wire Co., Ltd.	209
Fuller's United Electric Works, Ltd.	250	Stileman & Neate	99
A. V. Humphries	507	Sutcliffe, Speakman & Co., Ltd.	127
London, Midland & Scottish Railway Co.	163	Charles Turner & Co., Ltd. ...	65
Fred. Maund	57	Vernier Manufacturing Co. ...	55
		Jackson & Sons, Ltd.	263
		Trade creditors under £50	1,532

THE HATCHAM MANUFACTURING CO., LTD., 314, Gray's Inn Road, Holborn, London, W.C., electrical engineers, &c.—A meeting of the creditors of this company was held on January 15th at the offices. The chair was occupied by Mr. A. L. Leonard, accountant, of 8, Layer Gardens, Acton, who had been appointed to act as the liquidator in the voluntary liquidation of the company and as the receiver for the debenture-holders. A balance-sheet was presented showing the position as at November 14th last, the date of the appointment of the receiver, and this disclosed total liabilities of £4,306, made up as follows:—Share capital, issued and fully paid up, £1,500; debentures, £500; trade creditors, £1,261; income tax, &c., £245; and cash creditors, £800. The assets were estimated to realise £2,506, or a deficiency of £1,800. The assets consisted of: Goodwill, £319; plant, £50; furniture, £50; investments, £259; book-debts, £682; stock, £1,100; and cash in hand, £46. The liquidator stated that the goodwill had no value at the moment, whilst the stock might produce £250. The investments represented second debentures which were issued to the creditors in another company. He thought the assets would produce about £1,000. Since his appointment as receiver he had been continuing the business and executing orders from stock. The company was registered on June 24th, 1919, with a nominal capital of £3,000, of which £1,500 had been issued. Of the issued capital £1,000 was allotted for cash. The two directors of the company, who were also the shareholders, were Messrs. E. A. Endacott, and F. W. Carpenter. Under the articles the two directors were each entitled to draw £12 a week, but they had not received that amount, and were shown as cash creditors in the balance-sheet for £800. The debentures were created on September 3rd of last year. The holders were the two directors, and the consideration for the issue was money previously lent to the company. The last balance sheet of the company, before the issue of the debentures, was dated March 31st, 1923, and it showed a net loss on the previous year's trading of £350, whilst there were accumulated losses up to that date of £682.

Mr. HOUSTOUN suggested that the debentures were issued at a time when the company was not solvent, and that they had the effect of preferring Messrs. Endacott and Carpenter to the other creditors.

The CHAIRMAN: They safeguarded themselves to the detriment of the other creditors. The money in respect of which the debentures were issued was advanced in equal shares by the two directors in April, 1920.

Mr. C. WELLS, of the Wholesale Traders' Association, said it appeared that very shortly after the necessary three months had expired, and the debentures became valid, a receiver was appointed and liquidation was decided upon.

Mr. HOUSTOUN asked why the debentures were issued, and Mr. Carpenter replied that his co-director had been pressing for the return of his money.

In answer to questions, the CHAIRMAN said that since his appointment as receiver he had continued the business at a small profit. During the twelve months to March, 1923, the turnover was only £3,849, with a loss of £870. Mr. Carpenter added that during the first year of the company's existence the turnover was something like £25,000.

Mr. F. HASSELDINE asked if the debenture holders were prepared to give up their debentures, and the reply was in the negative, although it was stated that they would withdraw their claims in respect of arrears of salary.

Mr. HOUSTOUN asked the chairman whether it would be correct to say that if a realisation took place there would be nothing for the creditors.

The CHAIRMAN: I am afraid there will be very little.

Mr. Houstoun then intimated that unless the directors were prepared to meet the creditors, he preferred compulsory liquidation to take place, but it was definitely stated that the debenture holders would not give up their security.

On the motion of Mr. Houstoun, seconded by Mr. Hasseldine, a resolution was unanimously passed expressing the opinion that it was desirable that the company should be wound up compulsorily, and the creditors agreed to support a petition in due course. The following are creditors:—

	£		£
Avon Rubber Co.	45	*Hardware Trade Journal* ...	27
Barrow, Hepburn & Gale ...	117	Hudson & Son	30
Barrow Rock Belting Co. ...	170	McLellan & Co., Ltd.	23
S. T. Brown, Ltd.	69	Roads Motors, Ltd.	74
Credenda Conduits, Ltd. ...	53	C. A. Vandervell & Co., Ltd. ...	37
J. T. Dobbings, Ltd.	50	Walsall Electrical Co.	27
Dubilier Condenser Co.	48	W. F. Webb & Co.	85
Edison Swan Electric Co., Ltd.	21	Westwood Manufacturing Co. ...	27
Geipel & Co.	23	General Electric Co., Ltd. ...	21
A. Graham & Co.	21	Stella Conduits, Ltd.	47

FRANK CRAFT (CASTLEFORD), LTD.—A petition for the winding up of this company has been presented to the County Court of Yorkshire by Messrs. George Burn, Ltd., tube manufacturers, of Midland Street, Birmingham, and will be heard at the County Court, Wakefield, on January 29th.

A. E. G. ELECTRICAL COMPANY OF SOUTH AFRICA, LTD.—Last day for proofs for dividend January 31st. Liquidator, Mr. H. E. Burgess, Senior Official Receiver and Liquidator, Carey Street, W.C.

COUNTY OF DORSET ELECTRIC SUPPLY CO., LTD.—Meeting of creditors at Basildon House, Moorgate, E.C., on January 30th. Particulars of claims to be sent to the liquidator, Mr. L. W. Hawkins, Basildon House, forthwith.

ELECTRICITY HOUSE, LTD.—A meeting of members is called for February 20th at 79, Lichfield Street, Wolverhampton. Liquidator, Mr. D. E. Campbell.

PECKHAM TRUCK AND ENGINEERING CO., LTD.—A meeting of members is called for February 20th at 26, Audrey House, Ely Place, E.C., to hear an account of the winding-up from the liquidator, Mr. D. Haslett.

CRYSTOPHONE MANUFACTURING CO., LTD.—A meeting of members is called for February 18th at 4, Charterhouse Square, E.C., to hear an account of the winding-up from the liquidators, Messrs. E. H. Hawkins and A. A. Yeatman.

PARK ROYAL ENGINEERING WORKS, LTD.—According to the *Financial Times*, Mr. Justice Eve made a compulsory winding-up order in this case; also in the case of the Holborn Radio Co.

IRONCLAD SWITCHGEAR CO., LTD.—The liquidator in this voluntary winding-up (Mr. W. P. Masterton) reports that on investigation it was found that the assets of the company were very heavily over-valued in the statement of affairs presented to the creditors. The balance available for the unsecured creditors will only permit of a first and final dividend of 3½d. in the £.

Trade Announcements.—MR. EDWARD WRIGHT, electrical engineer, late of Messrs. John Wright & Sons, is carrying on business at Electric House, 43, Castle Street, Dover.

MESSRS. RATCLIFFE & SON, of the Westport Iron Works, Malmesbury, have added a wireless department to their business.

MR. ROBERT MARSDEN has retired from the firm of John Marsden & Son, electrical engineers, 1, Upperhead Row, Huddersfield, and the business will be continued by Mr. John William Marsden.

Catalogues and Lists.—MESSRS. ADAM HILGER, LTD., 75a, Camden Road, N.W.1.—An illustrated pamphlet describing optical gauges for various purposes.

MESSRS. J. & W. B. SMITH, LTD., 15,23, Farringdon Road, E.C.1.—List No. 172, illustrating the latest designs of "Redot" electric fires. Priced.

MESSRS. BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—A list of reduced prices of the company's products.

MESSRS. CHARLES ERITH & CO., Palace Chambers, Bridge Street, S.W.1.—A pamphlet illustrating "Riley" stokers, and advertising a 64-page catalogue.

MESSRS. W. CHRISTIE & GREY, LTD., 4, Lloyd's Avenue, E.C.3.—An illustrated brochure treating of methods for elimination of vibration and noise caused by machinery.

MESSRS. BELLING & CO., Derby Road, Edmonton, N.18.—An attractive coloured showcard advertising the firm's electric fires.

THE BRUSH ELECTRICAL ENGINEERING CO., LTD., Falcon Works, Loughborough.—Pamphlet No. 100/0-6A, containing reports from various power stations showing the economical operation of the 5,000-kW Brush-Ljungström turbo-generator.

MESSRS. ARNOLD & LARGE, LTD., 53, Broad Street, Birmingham.—Three postcards illustrating a lathe attachment for undercutting the mica of commutators.

THE ATHOL ENGINEERING CO., Cornet Street, near Broughton, Manchester.—Price lists of celluloid, "Celastoid," khaki webbing, and other materials.

MESSRS. G. & J. WEIR, LTD., Cathcart, Glasgow.—A well-illustrated catalogue of "Weir" pumps for feed-water and other purposes, valves, regulating gear, &c.

MR. H. B. TURNER, 79, Playford Road, London, N.4.—Illustrated and priced leaflet of electric measuring instruments, automobile and pocket types.

MESSRS. EDGAR W. DOREY & Co., Norwich House, Southampton Street, London, W.C.1.—New catalogue (16 pp.) containing illustrated description of their A.B.C. semi-Diesel crude oil engines.

MESSRS. COWLISHAW, WALKER & Co. (1920), LTD., Etruria, Stoke-on-Trent.—Illustrated pamphlet relating to "Output" bar coal-cutting machines.

Calendars and Diaries.—MESSRS. E. & E. KAYE, Ponders End, Middlesex, have sent us a calendar consisting of changeable slips mounted upon a small copper plate.

Mr. J. C. WHITE, of 49, Bridge Street, Deansgate, Manchester, has sent us a useful desk souvenir in the form of a combined pen-rack, ash-tray, &c. He has a few remaining for friends who have not received one already.

Book Notices.—"The Colliery Manager's Pocket Book, 1924." Edited by J. V. Elsden, D.Sc. (Lond.), and Hubert Greenwell, F.S.S., A.M.I.Mech.E. (Pp. 103+492). London: The Colliery Guardian Co., Ltd. Price 3s. net, cloth, or 4s. 6d. net, roan with gilt edges.—In addition to the usual features—production statistics, electricity in and about mines, ventilation, machinery, strength of materials, &c., this issue contains an interesting review of mining progress during 1923. This deals with the Eskmeals coal-dust explosion experiments; the appointment of Committees by the Secretary of Mines to consider and report upon various matters connected with the industry, and other matters relating to British mining during 1923. It is not confined to this country, however, many interesting details of progress in the United States, Belgium, and elsewhere being also given.

"The First Principles of Lifting Machinery," by G. T. Smith. (Pp. 40; 22 figs.) New Malden, Surrey: Vizetelly and Co., Ltd. (for the Association of Engineering and Shipbuilding Draughtsmen). Price 2s.—This is a reprint of a paper read before the Association, and forms a very interesting and informative guide to the mechanics of the subject, as well as dealing with the construction and application of lifting gear.

"The *Practical Engineer* Electrical Pocket Book and Diary, 1924." (Pp. 656). London: Oxford Technical Publications. Price 2s. 6d. net cloth; 3s. net pluvisine. The preface to this edition states that important revisions and extensions have been made in several sections. The section dealing with lifts and cranes has been re-written, and those relating to dynamos and motors have been carefully revised.

"Manual of Fuel Economy," by C. F. Wade. Pp. viii+144; figs. 40. London: Chapman & Hall, Ltd. Price 9s. 6d. net.

"Engineering Abstracts." No. 18. January, 1924. London: Institution of Civil Engineers.

"Post Office Electrical Engineers' Journal." Vol. XVI; Part 4; January, 1924. London: ELECTRICAL REVIEW, LTD. Price 2s. net.

"Galvanomagnetic and Thermomagnetic Effects.—The Hall and Allied Phenomena," by L. L. Campbell. Pp. xii+311; 128 figs. London: Longmans, Green & Co. Price 16s. net.

"*Journal* of the Institution of Electrical Engineers." Vol. LXII, No. 325; January, 1924. London: E. & F. N. Spon, Ltd. Price 10s. 6d.—This issue contains the following papers: "Industrial Research, with special reference to Electrical Engineering Development," by Mr. W. Wilson; "The Whirling of Shafts," by Mr. J. Frith and Mr. F. Buckingham; "A Dynamic Model of a Valve and Oscillating Circuit," by Mr. R. C. Clinker; and the chairmen's addresses to the North-Western Centre and the Tees-side Sub-Centre.

Electric Supply on the North-East Coast.—We have received from Mr. Andrew Gemmell a pamphlet giving an amplified report of a speech made by him as a shareholder, last March, at the annual meeting of the Newcastle-upon-Tyne Electric Supply Co., Ltd., on "The Syndicated Supply of Electricity on the North-East Coast and the Abuse of Statutory Powers."

British Empire Exhibition Notes.—Every State Department is to be represented in the British Government's Pavilion at the exhibition, including the Post Office, which will demonstrate both the scope of its operations and its methods. The working of high-speed telegraphy will be illustrated by a model of a long-distance line over which 400 words a minute will be transmitted in two directions simultaneously, while a machine will translate Morse signals into Roman characters and print them. The method by which four operators transmit and four others receive telegrams at the same time over a single line will be demonstrated.

The whole process of putting through local and long-distance telephone calls will be displayed in operation, together with the ingenious use of the thermionic valve for amplifying tone, and the mechanism of automatic telephony. The public will be given the opportunity of examining a replica of the radio receiving apparatus employed on the Cairo-Leafield route, and a model of the masts and equipment of the new Imperial radio station now under construction near Rugby. The Post Office London railway will be fully illustrated by models. The scheme was authorised by Parliament in 1913, but its execution was delayed by the war. It is an underground electric railway, designed to convey letters and parcels between the principal post offices and the main railway stations.

A preliminary programme has been issued of the Empire Mining and Metallurgical Congress that is to be held at the Exhibition on June 3rd to 6th inclusive. The Institution of Mining and Metallurgy, the Institution of Mining Engineers, the Iron and Steel Institute, and other organisations representative of the scientific and technical interests of the mineral and metal industries, also the colliery proprietors and iron and steel manufacturers of the United Kingdom, are represented on an Executive Committee which has the arrangements in hand. Viscount Long of Wraxall will preside over the main sessions, and a number of papers will be read. The president will deliver an address on "Mineral Resources and their Relation to the Prosperity and Development of the Empire." The offices of the Congress are at 225, City Road, London, E.C.1, and Messrs. C. McDermid and G. C. Lloyd are the general secretaries.

Owing, principally, to the difficulty in assessing the comparative merits of exhibits in such a vast display as that at Wembley, the Board has decided not to institute a competitive system of awards. This will meet the views of a great majority of the exhibitors. In place of such a system it is proposed to issue a commemorative medal, accompanied by a certificate, to each exhibitor in the sections arranged by the United Kingdom, Dominions, Protectorates, &c. Exhibitors participating in collective exhibits of products or manufactures organised by the United Kingdom or Oversea Governments, or in art or scientific research exhibits organised by Governments, associations, and committees, will receive a diploma of honour.

A joint committee of the non-ferrous metal trades is organising a section in the Palace of Industry. The aim of the exhibit is to reproduce in miniature all the various sections of the brass, copper, and nickel-silver industries.

The Japanese Earthquakes.—According to cable advices received by the Whiteball Trust, Ltd., in London, the Tokyo Electric Light Co., Ltd., suffered no damage in last week's earthquakes. It is added that the concern is rapidly recovering from the disastrous effects of the September earthquakes.

Russia and Foreign Experience.—Concerning the report on this subject which was published in our issue of January 18th, it is stated by a Moscow newspaper that the Electric Machine Trust of Petrograd has already secured a licence from the Berlin A.E.G. to utilise the technical experience, &c., of the latter undertaking, although Berlin reports characterise the assertion to this effect as being premature. The agreement would permit the trust to produce the heavy machines, turbines, &c., of the German company's types, the latter receiving in payment a percentage of the value of the Russian output in this direction and at the same time supplying the trust with certain intermediate products necessary for the constructional works.

Danish Municipal Visit to England.—*The Times* states that Mr. Anthon Andersen, Mayor of Copenhagen, and representatives of the Copenhagen Corporation, arrived in London at the beginning of last week, and proceeded to Scotland, where they have been visiting Edinburgh and Glasgow. Visits were also paid to Manchester and Birmingham. They returned to London on Friday night, staying at the Hotel Cecil. The object of the visit is to study British power stations, garden cities, &c. The electricity works at Greenwich and the London Electricity Railway power house in Chelsea, as well as the London Underground Railway system, were to be inspected.

Radio Apparatus for South Africa.—A writer in a recent issue of the *British South African Export Gazette* complains of the indifference of British manufacturers and suppliers of radio-telephone apparatus to the prospects offered by the South African market. Apart from the regular broadcasting of concerts by amateurs, which has been carried on in Johannesburg for some time past, there are a number of large broadcasting schemes afoot. A large station is being erected at Klipheuvel, Cape Province; the Publicity Department of the South African Railways and Harbour Board is to broadcast concerts with the object of raising funds for the Union's display at Wembley this year; and there is every probability of the erection of a powerful station at Durban by the Corporation. The opinion is expressed that 1924 will be a "wireless year," and British manufacturers are urged to secure a footing at once, lest Germany and America get there first.

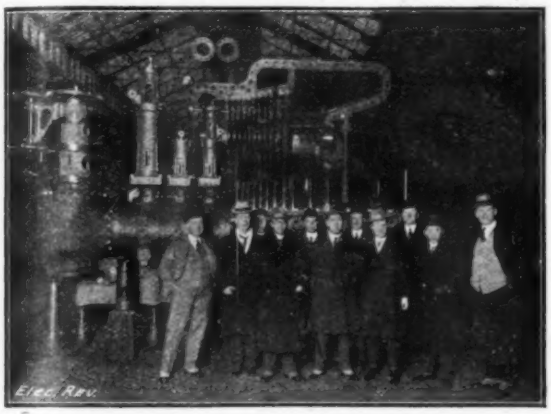
German Electrical Industry.—It was reported in Berlin on January 17th, says the *Financial Times*, that Stinnes's concerns, which had for some time past been suffering severely from the restricted amount of liquid capital available, had just secured credit from a Swiss consortium of 60,000,000 gold marks, repayable in ten years, so that the position was now relieved. The money will be used in the mining concerns Deutsch Lux Gelsenkirschen, Bochumer and Riebeck Montan, but not electricity works. This brings into prominence the long-standing rivalry inside the Stinnes's group of the Siemens Schuckert Electrical Combination. Unless Herr Stinnes allows the Siemens concern to benefit by his connections, a dissolution of the combination of the two concerns may be expected.

An Exchange Telegraph dispatch from Berlin on the same date says that the directors of the Allgemeine Elektrizitaets Gesellschaft do not propose a dividend for the year 1922-23, but they will carry forward 106 billion paper marks.

For Sale.—By order of the Postmaster-General, the Controller, Post Office Stores Department, invites offers for one marine-type dry back boiler lying at the Head Post Office, Manchester. (See this issue.)

Westinghouse and Japan.—Mr. E. D. Kilburn, vice-president and general manager of the Westinghouse Electric International Co., recently made a pronouncement upon the formation of an electrical manufacturing company (Mitsubishi Denki Kabushiki Kaisha) in Japan by the important Mitsubishi group, jointly with the Westinghouse Co. and Takata and Co., the well-known importers. The capitalisation, he said, was reported to be 15,000,000 yen. The principal reason for the formation of the company was the rapid progress of electricity in Japan, which had brought electrical machinery and apparatus to the head of the list of imported goods. It was desired to make Japan less dependent upon foreign countries in this respect. "The United States profits because if the Westinghouse Co. had not accepted this proposal it is possible that a German firm would have been considered by the Mitsubishi organisation." The new company, said Mr. Kilburn, was to have the advantage of the technical skill and experience of the Westinghouse Co., and the use of the patents.

The Chinese Mission at Trafford Park.—Several references to the visit of the Chinese Industrial Mission to this country have appeared in the ELECTRICAL REVIEW. By courtesy of the Metropolitan-Vickers Electrical Co., Ltd., we are enabled to publish the accompanying photographic view taken on the occasion of the visit of the mission to the company's works at Trafford Park on January 17th. The party consisted of the following:—



The Chinese Industrial Mission at Trafford Park.

The Head of the Mission: Chang Chien, Junior, Minister Plenipotentiary; High Commissioner of the Republic of China to investigate industrial conditions of Europe, America and Japan. Representative of the Union of Chambers of Commerce in China.

Secretaries: Chungtao T. Chu, Ph.D., and T. C. Hsi, mining engineer.

Attachés: Alex. Y. Lu, chemical engineer. C. F. Hsu, delegate of the Ministry of Communications, Peking. W. C. Chang, textile engineer. D. C. Hsu, engineer of the Conservancy Bureau of Tai Hu. Mr. Ottewell, of British Consular Service, China; and Mr. Evans, of the Department of Overseas Trade, were also present.

Traders and Railway Rates.—The Traders' Co-ordinating Committee, representative of the Federation of British Industries and other large railway-users' organisations, has addressed a letter to business firms throughout the country appealing for contributions to a fund to enable the case for lower railway charges to be adequately presented during the final stages of the inquiry which is being conducted by the Railway Rates Tribunal. It is estimated that not more than £20,000 will be needed to cover expenses in this matter.

Broadcasting Apparatus Boom in Sweden.—The demand for wireless broadcasting apparatus and accessories is at present enormous in Sweden and the existing firms are unable to satisfy requirements.—*Reuter's Trade Service* (Stockholm).

New Works near Melbourne.—An Exchange Telegraph dispatch states that Guest, Keen & Nettlefolds, of Birmingham, have decided to establish extensive works near Melbourne.

Wireless Discounts.—We are informed by the Wireless Retailers' Association that in view of the unremunerative discounts offered to retailers by many manufacturers, a committee of the Association is preparing a list of those firms that will allow favourable terms to its members. Copies of the list will be furnished to all members of the Association, and "manufacturers desiring to be included are invited to communicate with the Hon. Secretaries, 70, Finsbury Pavement, London, E.C.2."

Australia and British Meters.—A *Reuter* Trade Service dispatch by mail from Melbourne states that "Dumping duties have been imposed on pianos originating in or exported from the United States; also on brandy from Spain; *certain electricity meters from the United Kingdom;* drawing instruments from Austria; and glass lamp shades from Czecho-Slovakia," and so on.

New Australian Companies.—Recent electrical company registrations in Australia include:—

Martin de Launay, Ltd. (capital £20,000); directors: A. E. Martin and E. de Launay. Electrical suppliers and importers. Registered in New South Wales.

Associated Radio Company of Australia, Ltd. (capital £100,000), of 231, Collins Street, Melbourne. Directors: A. L. Brown and D. C. Cameron.

M'Quinn Electric Element Pty., Ltd., electrical engineers (capital £30,000), of 346, Flinders Street, Melbourne. Directors: P. Evans, J. Marshall, C. Howard, J. Grist, and M. Mornane, Jun.

Census of Production in 1924.—In the *London Gazette* for January 18th notice is given that under the Census of Production Act, 1917, the Board of Trade has ordered that a census shall be taken next year in respect of production in the year 1924.

Social Event.—On January 17th Tucker's Athletic and Recreation Club (Messrs. J. H. Tucker & Co., Ltd., Birmingham) held a social at the works canteen. The very successful function consisted of a concert, whist drive, and dance.

E.C.A. Dinner at Bristol.—The first annual dinner of the Bristol Branch of the Electrical Contractors' Association (Inc.) was held at Bristol on January 10th. Mr. W. B. Williams, chairman of the branch, presided, and among those present were the president of the Association (Mr. R. Robson), and the secretary (Mr. L. G. Tate). In responding to the toast of "The Association" Mr. Robson said that in electrical development this country was far behind America. He made special reference to the need for suitable apprentices, and urged members to foster amicable relations with the municipal authorities.

Inventions and Trade Marks in Russia.—Messrs. King's Patent Agency, Ltd., write stating that legislation permitting the patenting of inventions in Russia under the new régime is now in a fair way of being consummated, and the registration of trade marks may, it is hoped, after reciprocal treaties have been concluded, follow subsequently. They add: "British patentees and manufacturers are advised to be early in the field to secure priority and thus protect their rights against infringement."

Telephone Apparatus Production in Germany.—According to a statement issued by the Telephone Works Co. (late J. Berliner), a satisfactory state of business was experienced by the company in the year ended with last June, as was also the case with the associated works as represented by the Sudicatis firm, the Mark Telephone Factory, the North German Telephone Factory, the South German Telephone Factory, the West German Telephone Factory, and the Magdeburg Telephone Co. The Berliner Co. proposes to carry forward the profits for the past year. On the other hand the South German Telephone Apparatus, Cable and Wire Works Co., of Nuremberg, which belongs to the Felten and Guilleaume group, reports profits of 15,359 millions of marks, the method of disposal of which is not specified.

Catalogues Wanted.—THE WESTON ENGINEERING AND DISPOSALS CO., LTD., of 2a, Alexandra Road, Moss Side, Manchester, wish to receive catalogues and lists of electrical accessories, including wireless.

MR. J. S. PLUMTREE, 90-91, High Holborn, London, W.C.1.—Price list of cable, flexible cords, and bell wires.

A Large Indian Transformer Contract.—MESSRS. FERRANTI, LTD., have received an order from the Tata Power Co., Ltd., Bombay, for the supply of four banks of 110,000-V power transformers. Each bank has a capacity of 30,000 kVA, the largest ever ordered in Great Britain.

Germany and Shanghai. — *Reuter's Trade Service* (Shanghai) quotes *Finance and Commerce* as stating that the Germans are capturing a large portion of the machinery business there, especially electrical power plant equipment, hand tools and machine tools. "The indications are that Germany will continue to increase her hold on this market. Of the total of over 12 million taels' worth of machinery imported into Shanghai during the first nine months of 1923, Germany had to her credit over 1¼ million taels."

Railway Works.—It is stated that new engine and repair sheds are to be constructed for the Southern Railway at Exmouth Junction, and that the contract for the first section, which is in the hands of Messrs. A. Jackaman & Sons, Ltd., of Slough, will include a good deal of electrically-driven machinery, crane, turntable, and other equipment.

The World Power Conference.—An announcement has been issued regarding the conditions and privileges of membership of the World Power Conference. We shall refer to the subject more fully next week, but in the meantime would refer those who desire membership to apply for particulars to the Secretary of the Conference at 36, Kingsway, London, W.C.2.

Lighting and Power Notes.

Accrington.—BULK SUPPLY.—The Corporation has received a communication from the Burnley Corporation intimating that it is unable to accept the heads of agreement recently submitted to it for the supply in bulk of electrical energy by Accrington Corporation. For the present, negotiations have been discontinued.

Birmingham.—AREA EXTENSION.—The Corporation is applying to the Electricity Commissioners for a Special Order authorising it to extend its area of electricity supply so as to include the Urban District of Perry Barr.

Bredbury and Romiley.—ELECTRICITY SCHEME.—The Urban District Council has instructed Mr. R. Lomax, electrical engineer, to prepare a report on an electricity scheme for the districts of Whaley Bridge, Hayfield, New Mills, and Disley.

Bridge of Allan.—SCHEME OPPOSED.—The Town Council has decided to lodge objection to the application of the Scottish Midlands Electricity Supply Co., Ltd., for a Special Order authorising it to supply electricity in the borough.

Canada.—HYDRO-ELECTRIC POWER DEVELOPMENT OF THE ST. LAWRENCE.—A delegation of 200 representatives of Ontario municipalities have conferred with the Federal Government on the subject of co-operation between the Federal and Provincial Governments to secure the most rapid hydro-electric power development of the St. Lawrence River. The proposals involve the construction of a dam across the river near Morrisburg at an estimated cost of $80,000,000 for the development of 6,000,000 h.p. for use in the districts of Eastern Ontario. The shares of the Canadian and United States Governments are jointly estimated at $15,000,000, and the Province of Ontario would finance the balance. In reply, Mr. Mackenzie King, the Prime Minister, promised that the matter should have the careful consideration of the Cabinet, having in view all the interests concerned, national and international.—*Reuter* (Ottawa).

MANITOBA WATER-POWER DEVELOPMENT.—Representatives of English capitalists are conferring with the Government regarding the acquisition of plant and equipment for the provincial water-power system. A tentative offer has been made, but, pending the consideration of the matter by the Government, no details have been announced.—*Reuter* (Winnipeg).

Ceylon.—HYDRO-ELECTRIC DEVELOPMENT.—It is understood that steps may shortly be taken to put into operation the plans for the development of Ceylon's water power, which have been under consideration for some time. According to the *Bulletin* of the Federation of British Industries, a draft scheme formulated by the Director of Public Works and approved by the Government's consulting engineers, has been published, and the Finance Committee of the Legislative Council is to be asked to vote the necessary funds. The scheme, which would utilise water to be obtained from the Aberdeen and Laxapana catchment areas, covers four stages, the first of which is estimated to involve an initial expenditure of Rs. 10,710,000 on power-station construction and equipment, dam building, receiving station, transmission lines, &c., and an annual upkeep cost of 10 per cent. of that sum. This would provide 10,000 kW delivered in Colombo and distributed over an area of 25 miles radius. Later stages provide for increased plant to meet the requirements of local industries, extended tramway and lighting services, and railway electrification. It is estimated that the sale of electricity would at first bring in an annual 4.48 per cent. on the capital outlay, increasing with each new stage of development.

Continental.—FRANCE.—Owing to a short circuit, the electricity supply failed on January 16th in a large area in the middle of Paris, which was in darkness for over an hour and a half.

HOLLAND.—The Société des Tramways et Eclairage de Flessingue-Middelbourg, in order to meet the increasing demand for current for lighting purposes, has recently added a new 1,000-kW generating set to its electricity station in Flushing.

Gillingham (Kent).—BULK SUPPLY.—The Town Council is to ascertain the cost of obtaining a bulk supply of electricity from the Kent Electric Power Co. The Council had approached the Electricity Commissioners with regard to the possibility of obtaining a loan for the provision of additional plant at the electricity works, the cost of the alternative schemes submitted by the electrical engineer being £21,635 and £15,210. The Commissioners have intimated that before they could sanction any loan or allow the Council to proceed with a scheme, they would have to be satisfied that the Council could generate electricity at a cost less than that of obtaining a bulk supply from the nearest generating station.

Gloucester.—PLANT EXTENSIONS.—The Electricity Committee has decided to erect additional feeder cables to the Tredworth and Southend districts at an estimated cost of £10,000 and £2,500 respectively, and has instructed the electrical engineer to prepare plans for the erection and equipment of a new power station.

Hull.—NEW PLANT.—It was decided at the last meeting of the Electricity Committee that extensions be made to the St. Andrew's Dock sub-station, also that a larger and more up-to-date sub-station be erected in the place of the one in St. George's Road. The scheme will cost £103,000. The chairman of the Committee has interviewed the Electricity Commissioners with regard to an unemployment grant, and the Commissioners have undertaken to consider favourably an application in that respect.

Isle of Wight.—ELECTRICITY SCHEME.—The Isle of Wight Electric Light and Power Co. is considering the provision of a supply of electricity in the West Wight area, and, subject to sufficient support being obtained, the work will be proceeded with almost immediately. The proposal is to build a power station midway between Freshwater and Totland, and to distribute chiefly by means of overhead cables. It is anticipated that a supply of electricity could be available by September next.

Lytham-St. Annes.—INAUGURATION OF SUPPLY.—The electricity supply from the St. Annes works to Lytham was formally inaugurated by the Mayor on January 16th. Th electrical energy is tranmitted at a pressure of 6,600 V and transformed down to 240 V at the sub-station. One thousand consumers have been connected, and as the plant is working to full capacity, a supply in bulk is to be obtained from Blackpool.

Middlesbrough.—AREA EXTENSION.—Application is being made to the Electricity Commissioners by the Corporation for a Special Order authorising it to extend its area of supply so as to include the parishes of Ormesby, Marton, and Nunthorpe.

Mid-Lancashire Electricity District.—The first meeting of the Interim Advisory Board of the Mid-Lancashire Electricity District was held at Blackburn on January 9th. Alderman T. E. Higham, chairman of the Accrington Electricity Committee, was elected chairman, and Ald. T. Parkinson, chairman of the Preston Electricity Committee, vice-chairman of the Board. The meeting considered the applications of the Lancashire Electric Power Co. and the Burnley Corporation with regard to the generating station proposed to be erected near Padiham, and referred it to the Engineers' Committee to be reported upon at the next meeting, to be held at Blackburn on February 4th.

Milnrow.—LOAN SANCTIONED.—The Urban District Council has received the sanction of the Electricity Commissioners to the borrowing of £7,798 for mains, services, meters, and sub-station equipment.

Northern Ireland.—HILLSBOROUGH.—The Hillsborough Electrical Supply Co. is applying to the Electricity Commissioners for Northern Ireland for a Special Order authorising it to supply electricity to certain townlands in the rural district of Hillsborough.

Parliamentary Bills.—The North Metropolitan Electric Power Supply Co. has deposited a Bill for introduction into Parliament under which power is sought to extend its area of supply in Hertfordshire and Essex and to raise further capital. A new generating station is to be erected in Enfield in close proximity to the company's existing Brimsdown station. Power is sought to raise £500,000 nominal additional capital and to issue this capital so that it shall form a special class. In respect of this additional capital, power is sought to raise by the issue of debenture stock any sum not exceeding £250,000, and to borrow a further £650,000.

A Bill to confer further powers upon the County of London Electric Supply Co. has been deposited to extend the company's area of supply. The company is erecting a generating station at Barking, from which a supply of electricity will be available for use in Essex. The Bill proposes to extend the company's area of supply to the whole of that county, and, within that extended area, to supply electricity to authorised undertakers, to any local authority, to persons requiring a supply for power, and to any person for lighting or domestic purposes in any area which does not form part of the supply area of any authorised distributor. The maximum price to be charged to any authorised undertakers for electricity in bulk is not to exceed 4d. per kWh, and the maximum price for electricity supplied, otherwise than in bulk, is not to exceed 1s. per kWh. Power is given to the Electricity Commissioners to revise these prices in ten years' time.—*Financial Times.*

Prestwich.—ELECTRICITY SUPPLY.—The Urban District Council has been in communication with the Salford Corporation for an electricity supply. The Salford borough electrical engineer states that to place the Corporation in a position to give an adequate supply for the winter of 1924-5, it is essential that additional mains should be provided and further equipment installed at the Prestwich sub-station at an estimated cost of £6,900. The Urban District Council has approved of the proposed capital expenditure.

The Urban District Council is to consider at its next meeting the question of the control of the electricity undertaking. Should the Council desire to resume control it will be necessary to give six months' notice of such intention, prior to March, 1925, to the Salford Corporation, failing which the latter authority will exercise its powers for a further period of five years.

Price Reductions.—Reductions in the charges for electricity have been made, or recommended, in the following districts:—

BRIERFIELD.—Lighting: A reduction of ¼d. per kWh. Power: A reduction of ¼d. per kWh.

TORQUAY.—Domestic supplies: The standing charge to remain unchanged, but the "unit" charge is reduced to 1½d. Power: The flat rate has been superseded by a quarterly standing charge of 12s. per horse-power installed, plus 1½d. per kWh. Domestic power: 1½d. per kWh. Supply in rural districts: The standing charges to be increased by 10 per cent., with a "unit" charge of 1½d. per kWh.

PLYMOUTH.—Lighting: From 6½d. to 5½d. per kWh.

HARROGATE.—Lighting: From 6d. to 5d. per kWh. Power: From 1¾d. to 1½d. per kWh.

Richmond (Yorks.).—PROPOSED ELECTRICITY SUPPLY.—The Town Council has appointed a committee to consider an electric lighting scheme for the borough. It is suggested that a supply of electricity might be obtained from the authorities at the camp.

Rugeley.—ELECTRICITY SUPPLY.—The Electricity Commissioners have informed the Urban District Council that they have decided not to grant the application of the Cannock Urban District Council for an Order to include the Rugeley Urban District in its area of supply. The Council has asked the Lichfield Rural District Council to meet a deputation to discuss an electricity scheme.

Sheringham.—EXTENSION OF SUPPLY.—The Sheringham and District Electricity Supply Co., Ltd., has applied to the Electricity Commissioners for a Special Order authorising it to supply electricity in the Urban District of Sheringham and certain parishes in the Rural District of Erpingham.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Western Electric Distributing Corporation, Ltd., to supply electricity in parts of the borough and rural district of Andover, and the Town Council of Redcar to supply electricity in the borough of Redcar.

St. Ives (Hunts.).—ELECTRICITY SCHEME.—The Town Council has referred to the General Purposes Committee a proposal to carry out an electric lighting scheme for the town. The scheme includes the erection of the Council's own generating station.

Stafford.—LOAN.—The Town Council is applying to the Electricity Commissioners for sanction to the borrowing of £24,500 for additional plant, &c., at the electricity works.

Stockton-on-Tees.—LOAN SANCTIONED.—The Electricity Commissioners have sanctioned the borrowing by the Electricity Committee of £14,986 for extensions to Norton, Grange Estate, and Raby Road. In connection with the proposal to supply electricity to Heartburn and district with a view to relieving unemployment, the Unemployment Grants Committee having agreed to make a grant of 50 per cent. of the interest on the loan to meet expenditure on mains, sub-stations, and equipment, the Electricity Committee has decided to take the necessary steps to carry out the work and also to apply to the Electricity Commissioners for sanction to the borrowing of £6,400.

Swindon.—NEW FEEDER.—The Town Council is to lay a feeder cable from the electricity works to Park Lane at an estimated cost of £2,350.

Warrington.—SPECIAL ORDER.—At the request of the Lymm Urban District Council, the Corporation is applying to the Electricity Commissioners for a Special Order authorising it to supply electricity in the Council's area.

Westgate-on-Sea.—ELECTRICITY SCHEME.—The Isle of Thanet Electric Tramway and Lighting Co., Ltd., has placed before the Parochial Committee an electric lighting scheme for Westgate and Birchington. The Committee has asked the manager of the company, Mr. J. A. Forde, J.P., to meet the Committee to go fully into the matter.

Tramway and Railway Notes.

Bradford.—RAILLESS CARS.—The question of running further railless cars instead of renewing the tramway track on certain routes is to be considered at a special meeting of the Tramways Committee.

Brighton.—TRACK RENEWALS.—The Corporation proposes to renew the tramway track between Viaduct Road and Grantham Road at a cost of £9,300, and is applying to the Unemployment Grants Committee for a grant towards the cost of the scheme.

Continental.—BELGIUM.—According to a report recently issued by the Société Nationale des Chemins de Fer Vicinaux, of Brussels, the company is making steady progress with the electrification of its system of local railways. Work is well in hand with the Espinette-Waterloo and Brussels-Waterloo (Mont Saint Jean) lines, while the electrification of the Dieghem-Haecht section of the Brussels-Haecht line is approaching completion, the first section having been electrically equipped before the war. During the course of the present year the Brussels-Dilbeek electric railway is to be extended to Schepdael, while plans are being prepared for the electrification of the line between Schepdael and Ninove. Other lines on which it is proposed to adopt electric traction are Grimberghen-Humbeek and Meysse-Londerzeel, with a direct branch to Laeken (Gros Tilleul).

SPAIN.—The board of the Compañia de los Ferrocarriles Vascongados have decided to electrify and straighten the track of its railway line from Bilbao to San Sebastian. The work will involve the outlay of 47,000,000 pesetas, and in view of the fact that the railway will revert to the State at the end of the term of its concession, the company is applying for a State guarantee of the interest of 5 per cent. on the capital which it proposes to raise.—*La Energia Electrica.*

Huddersfield.—NEW CARS.—The Corporation has purchased ten covered-top, double-deck tramcars at a cost of £1,600 each. The cars, which were assembled at the Corporation works, have seating accommodation for 64 passengers. This addition brings the total number of cars in Huddersfield to 136.

Irish Free State.—DUBLIN.—According to Mr. E. A. Aston, hon. secretary of the Greater Dublin Reconstruction Movement, a step proposed to be taken during the present year is the conversion of the Harcourt Street, Dublin, to Bray, railway into an electric railway, giving direct service from Carrickmines, Shankill, Foxrock, and Stillorgan to Nelson's Pillar, Dublin.

Leicester.—REDUCED FARES.—The Tramways Committee has re-introduced 1d. fares on the tramway system, and transfers have been reduced from 2d. to 1½d.

Longridge.—HELLIFORD LIGHT RAILWAY.—The Longridge Urban District Council has decided to invest £1,000 in the scheme for the construction of a light railway from Longridge to Hellifield, subject to the sanction of the Ministry of Transport. Bowland Rural District Council has agreed to subscribe £12,500 towards the same project.

London.—COLLISIONS.—Two London County Council tramcars came into collision just south of Westminster Bridge on January 13th. The cars were approaching the points adjoining the County Hall, which one of them failed to take accurately, with the result that they crashed together. Fortunately the impact was not heavy, but the driver of one car and several passengers received slight injuries from flying glass.

A collision occurred between an omnibus, a tramcar, and a coal wagon at Archway Road, Highgate, on January 16th. The tramcar crashed into the wagon, which overturned. The front of the tramcar and the omnibus were badly damaged, and the driver of the coal wagon was seriously injured.

UNDERGROUND STATION IMPROVEMENTS.—A reorganisation of the traffic is to be taken in hand immediately at Victoria Underground station to facilitate the transit of passengers to and from the platforms and street and subways leading to the Southern Railway station. The present inwards staircases deposit the passengers on the platforms at a point near the west end of the station. Two new staircases are to be built leading to the centres of both platforms, thus eliminating the congestion at the end of the platforms. Work on the new staircases is to commence at once.

The "Angel" Underground station is being reconstructed. The front of the station is to be entirely remodelled so as to considerably widen the entrance. Inside the station a much larger circulating space for the traffic is to be provided, and passimeters will take the place of the old type of booking office. Escalators are impracticable owing to the extreme depth of the tube from the street level. To secure a quick transit from booking hall to platforms, however, new high-speed lifts are to be introduced which will enable passengers to reach the trains within 80 or 90 seconds of entering the station. These lifts will be a further improvement on the type used on the Underground system generally. In addition to the foregoing improvements, the platforms are to be lengthened to 350 ft. Simultaneously with the opening of "Angel" station for traffic, the new tube link between Camden Town and Euston will also open. Thus, Islington will be directly connected with Golder's Green, Hendon, and Highgate, and eventually Edgware and Morden when the latter extensions are complete.

Newcastle and Gateshead.—JOINT TRAMWAY SYSTEM.—The engineer and general manager of Newcastle-on-Tyne Corporation Tramways, Mr. Ernest Hatton, has issued a statement regarding the working of the joint Newcastle and Gateshead tramway service over the high-level bridge spanning the Tyne, which has just completed its first year, in which he gives the following figures:—Twelve months' passengers, 13¼ millions; total penny bridge fares, £56,200; highest number of passengers in one week, 332,000. The principle which governs the through running between the two districts is that each party—the City Corporation and Gateshead Tramways Co.—retained its receipts on its own system, and received working expenses for the cars running on the other tracks. The expenses were balanced by running an equal number of car miles on each side. With regard to the revenue, Newcastle's share of the £56,200 for the last twelve months was £34,000, the balance

going to the Tramways Co. The costs of the alterations to the bridge to accommodate the tramways was approximately £25,000, of which the City paid about £14,000.

Wigan.—TRAMWAY IMPROVEMENTS.—The Tramways Committee has instructed the manager to report on the reconstruction of the Martland Mill Bridge route, this being the last of the narrow-gauge routes, with a view to reconstructing it with broad-gauge track, or, alternatively, with railless vehicles or petrol omnibuses.

Telegraph and Telephone Notes.

Channel Cables.—NEW LONDON-PARIS CIRCUIT.—Negotiations have been opened between the French Government and the Eastern Associated Telegraph Co. for direct cable communication between London and Paris, and two directors of the Eastern Co. are to visit Paris to make the final arrangements. The cable from London to Emden, which was recently announced, is not designed to favour Germany at the expense of France, but the proposed London-Paris direct wire will balance that concession, says the *Evening News*.

Indo-China.—DIRECT RADIO COMMUNICATION.—Direct radio communication between France and Indo-China was to be inaugurated on January 17th. The great station at Saigon will communicate with Bordeaux, a distance of 10,000 kilometres (6,250 miles), passing over the Himalayas. It is not only to be used for communication with France, but is to become the centre of a network of stations on French as well as foreign territory.—*The Times*.

Radio-Telegraphy.—LONDON-VIENNA SERVICE OPENED.—A radio telegraph service between England and Austria was officially inaugurated on January 12th. The service is operated by Marconi's Wireless Telegraph Co. in conjunction with the Austrian Marconi Co., and is a direct and continuous duplex service, transmission passing from Radio House, London, through the station at Ongar, Essex, to Laaerberg, where the messages are automatically relayed to the Central Office at Renngass 14, Vienna. Transmission from Vienna is carried on through the Deutsch-Altenburg station, and messages for Great Britain are received at the Brentwood station and automatically relayed to Radio House. The transmission of a message between London and Vienna takes from 10 to 15 minutes, the rates being for the present the same as those for landline telegraphy.

A wireless service between Vienna and Berlin has also been opened, and the operations of the Austrian station will in time be extended to place Vienna in radio communication with all the principal European cities.

Sweden.—AUTOMATIC TELEPHONES.—A beginning has been made in Sweden with the introduction of automatic telephone systems, an experimental exchange having now been opened in the Vasastad in Stockholm. The system which has been adopted is that devised by Mr. Hultman, a Swedish engineer. Another automatic system is to be tried at Sundsvall.

The Telephone Service.—NEW LONDON COIN-BOXES.—Telephone coin-boxes are to be installed at Charing Cross and Victoria Stations in order to obviate the present difficulties of making toll-calls from unattended call-boxes. At present it is necessary to collect a handful of pennies, but the new boxes will have separate slots for shillings, sixpences and pennies. To call the operator, 2d. must be put in the box at the outset, and the caller will then be told the charge for the call required. Say, for instance, it is 1s. 9d. The caller will then be asked to put in another 1s. 7d.—a shilling, sixpence, and a penny. The money is released by the subscriber pressing a button, and if he cannot get his call he gets his money back by pressing another button.—*Evening News*.

NEW LIVERPOOL EXCHANGE.—On January 12th a new telephone exchange was opened in Walton (Liverpool) to replace the existing Walton exchange. Subscribers, with few exceptions, retain their present numbers.

Radio Notes.

Belgium.—BROADCASTING.—The programmes of the Brussels broadcasting station are to be extended shortly. In addition to conferences and talks on various subjects, opera will be transmitted from the Théâtre de la Monnaie. Concerts from London and Paris will also be relayed.—*Daily Mail*.

India.—LIMITED BROADCASTING.—The Government of India has issued its first private radio transmitting and receiving licence to the Radio Club of Bengal (Calcutta), under the terms of which weather reports, concerts, &c., and non-political lectures, but not news items, can be transmitted to members of the club only. According to *Reuter*, the secretary of the club states that efforts to pick up London broadcast matter in Calcutta have been partially successful, but attempts to listen to Paris failed.

Irish Free State.—BROADCASTING COMMITTEE.—The special committee on the Postmaster-General's proposals for broadcasting in the Irish Free State met at Leinster House, Dublin, during the past week, and will continue to sit concurrently with the session of Dail Eireann.

The result of the deliberations of the Dail Committee will not be ready for the House until the 31st inst. The main question before the Committee is the proposal that the State should pass over the right to licence and tax incoming apparatus to a clearing house under the control of a private company. According to Lobby rumours, an unexpected development has taken place as a result of the Committee's discussions.

Radio Broadcasting.—TRANSATLANTIC TESTS.—There seems to be considerable misconception prevailing as to both the size of the KDKA station and the special experiments that the Westinghouse Co., in conjunction with the Metropolitan-Vickers Co. (2AC) have been conducting with a view to rendering American broadcast programmes audible in this country. As long ago as September, 1923, the Westinghouse Co. inaugurated 100-metre transmission with a power of 1½ kW. Since that date, the power input has been considerably increased, and the strength of reception has improved accordingly. The power of KDKA, while small in comparison with commercial radio telegraph stations for long-distance work, is now greater than the combined power of all the B.B.C. stations, and not very small as has been stated. The increase of power referred to raised some fresh difficulties, as it was found that the reproduction of speech and music was usually so distorted as to render it unintelligible, due to the phenomenon of "night distortion" and caused by slight changes of wavelength. To overcome this difficulty the associated companies arranged special experimental transmission after 4 a.m. Greenwich time, when the normal American broadcast programme had ceased. By this means the best adjustments were arrived at, with the result that intelligible programmes were re-radiated in this country before the close of the old year. On January 5th, the entire evening programme from Pittsburgh was re-radiated and recently it has been easy to listen to this station each night on a 102-m. wave length.

A BROADCASTING BOARD.—The report of the Broadcasting Committee in October last year included a recommendation that a Broadcasting Board should be established by statute to assist the Postmaster-General in the administration of, and to advise him on, important questions concerning the service. The Postmaster-General announces that he has appointed the following members to a Board:—

Major-General Sir Frederick Sykes, K.C.B., C.M.G., M.P. (Chairman); Lord Riddell; Sir Francis Ogilvie, C.B.; Mr. F. J. Brown, C.B., O.B.E.; Mr. Guy Burney; Mr. Walter Payne, O.B.E.; Mr. J. C. W. Reith; Mr. A. A. Campbell Swinton, F.R.S.; and a representative of Labour (to be nominated later).

Sir F. Sykes was the chairman of the Broadcasting Committee. Lord Riddell will represent newspaper interests. Sir Francis Ogilvie has been chairman of the Geological Survey Board since 1920. Mr. F. J. Brown is assistant secretary at the General Post Office, and is in charge of the telegraph branch. Mr. Walter Payne is vice-president of the Entertainments' Protection Association and the Society of West-End Theatre Managers. Mr. J. C. W. Reith is the general manager of the British Broadcasting Co., and Mr. Campbell Swinton was president of the Radio Society of Great Britain. —*The Times*.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Aberdeen.—January 28th. Corporation. Electric lighting installation for the Torry housing scheme. Mr. A. H. L. Mackinnon, architect, 245, Union Street, Aberdeen.

February 18th. Electricity Department. Two water-tube boilers, with superheaters, economisers, draught fans, steel chimney, piping, and accessories. (See this issue.)

Australia.—SYDNEY.—March 3rd. Harbour Trust Commissioners. Two 3,000-ft. lengths of electric submarine cable.

March 5th. New South Wales Government Railways and Tramways. Ironclad switchgear for Prince Alfred, Meeks Road, and Hurstville sub-stations.*

MELBOURNE.—May 22nd. Commonwealth of Australia. Automatic common battery telephone equipment. Schedule, N.S.W. 74. (January 18th.)

Belgium.—January 30th. Belgian Post and Telegraph Authorities at La Salle Madeleine, Brussels. 12 kilometres of 21-conductor telephone cable.

Bexley.—February 7th. Electricity and Tramways Department. Two groups of 700-kVA Scott-connected transformers; one 150-kVA single transformer; two 300-kW rotary converters, complete with transformers and all accessories; e.h.p., h.p. and l.p. switchgear, cables and connections within the station. (January 18th.)

Bradford. — January 28th. Tramways Committee. Supply of six railless electric vehicles and spare parts. Mr. R. H. Wilkinson, general manager, 7, Hall Ings, Bradford.

Carlisle.—February 15th. Electricity Department. Four water-tube boilers complete with stokers, &c.; electrically-operated overhead turbine-room crane; 6,000-kW turbo-alternator and condensing plant; switchgear. January 18th.)

Croydon.—January 28th. Electricity Committee. 50-ton electric crane; one 10,000-kW turbo alternator. (January 18th.)

Douglas (Isle of Man).—February 4th. Education Authority. Heating and lighting installation at the secondary school for boys. (See this issue.)

Edinburgh.—February 11th. Electricity Supply Department. E.h.p. and l.p. switchgear for sub-stations. (See this issue.)

Egypt.—CAIRO.—The Director-General, Section of Municipalities and Local Commissions, Savoy House, Cairo.

March 20th.—Supply and installation of electrical works and system at Benha.

March 27th.—Supply and installation of electrical works and system at Chebin el Kom.

April 3rd.—Supply and installation of electrical works and system at Miniet el Kamh.

April 10th.—Supply and installation of electrical works and system at Beni-Mazar.

Hamilton.—January 26th. County of Lanark District of the Middle Ward. Electric lighting installation in connection with 58 houses at Carmyle. Mr. P. C. Smith, Housing Department, District Offices, Hamilton.

Kettering. — February 4th. Electricity Department. 25 miles l.p., l.c., s.t. cable and nine miles l.t., l.c., s.t. cable joint boxes, slabs, &c. (See this issue.)

Liverpool. — January 31st. Electricity Department. Twelve months' supply of materials, including cables and accessories, meters, electric lamps, sundries, &c. (January 18th.)

London.—LONDON COUNTY COUNCIL.—February 11th. H.p. and l.p. switchgear, comprising h.p. switchgear with control panels and d.c. switch panels for 2,000-kW rotary converters. (January 18th.)

METROPOLITAN ASYLUMS BOARD.—January 30th. Installation of a 144-tube economiser; new continuous drying machine; engineering work for new central boiler house; revising laundry engineering arrangements and installing electric light and power wiring in boiler house and laundry. (January 11th.)

Manchester.—February 4th. Electricity Committee. One locomotive jib crane and grab. (January 18th.)

New Zealand.—WELLINGTON.—March 5th. Post and Telegraph Department. Supply of screwed bridle rings. Ref. 1293/ED./EC/2).*

INVERCARGILL.—February 4th. Town Council. Five 100-kVA, eight 50-kVA, and eight 30-kVA 3-phase transformers.*

TARANAKI.—February 6th. Electric Power Board. Supply of No. 1 pipe line, 3,895 ft. of pipe fittings and accessories; two large sluice valves. (Ref. 12919/ED/EC/2.)*

Norwich.—February 26th. Corporation. Works in connection with Thorpe power station :—Two 24-in. and one 3-in. electrically-driven centrifugal pumps; e.h.p. main switchgear, e.h.p. auxiliary switchgear, l.p. auxiliary switchgear; cable connections, &c.; overhead mono-rail telpher coal conveying plant; four steel-tube fuel economisers, two steel chimneys, four electrically-driven suction draught fans. (See this issue.)

Rathmines (Ireland).—January 30th. Rathmines and Rathgar Urban District Council. Steam coal for electricity works. Tender form from electricity works.

Salford.—February 11th. Electricity Department. Coal supplies for six months commencing March 1st, 1924. Particulars and form of tender from Borough Electrical Engineer, Frederick Road, Salford.

Sheffield.—February 4th. Tramways and Motor Department. 25 double-deck vestibule tramcar bodies, complete with trucks and electrical equipment. (January 18th.)

Sleaford.—February 6th. Electricity Department. Storage battery 118 cells. (See this issue.)

South Africa.—JOHANNESBURG. — February 28th. Turbo-generator plant and accessories.*

March 8th. Electricity Supply Commission. Tenders for the establishment and working of a proposed undertaking for the supply of electricity to the railways in the neighbourhood of Cape Town. (January 11th.)

March 8th. Electricity Supply Commission. Electrification of South African railways. Plant required in connection with the supply of electricity to the railways in the neighbourhood of Cape Town.

March 8th. South African Railways and Harbour Board. Electrification of Cape Town and Simonstown lines, motor bogies and electrical equipment of coaches. (January 11th.)

MAFEKING.—February 29th. Municipal Council. Electricity generating plant.*

Stockport. — February 10th. Tramways Department. Overhead electrical equipment of new tramways in Kew Road and Eastbourne Road, Birkdale. (See this issue.)

Stoke-on-Trent.—February 13th. Electricity Department. H.p. single-phase ironclad switchgear, coal bunkers, conveying plant, e.h.p. ironclad switchgear, e.h.p. truck-type sub-station switchgear, and static transformers. (January 18th.)

February 13th. Electricity Department. Constructional steelwork, &c. (See this issue.)

Tiverton.—February 8th. Town Council. Buildings and plant in connection with the installation of an electricity supply in the town :—Power-house buildings; gas engines and generators; main l.p. switchboard; balancer-booster set; battery; hand-operated travelling crane; mains—underground and overhead. (January 18th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—SYDNEY.—Electricity Supply Committee. Accepted :—

Induction pressure regulators (£20,283).—Metropolitan-Vickers Electrical Co., Ltd.

H.p. underground split conductor 3-core cable (£31,656); h.p. underground 3-core cable (£43,448); l.p. underground cable (single core) (£13,183).—Noyes Bros. (Sydney), Ltd. *Tenders.*

SYDNEY, N.S.W.—We quote the following from the *Sydney Sun* for November 29th :—" Preference to British-made goods has been discarded by the City Council in the purchase of 5,000 gasfilled electric lamps. This action has been taken on the ground that the preference involved was too high.

" For the supply of 2,000 150-watt lamps six tenders were received. The lowest, £212 10s., was submitted by the Australian General Electric Co. The lamps offered were of American make. Next came a tender for lamps made in Holland. The price stipulated was £230. Third on the list was a tender for British lamps at £260 8s. 4d.—a preference of 22.6 per cent. Council accepted the lowest tender.

" In the case of the supply of 1,000 500-watt lamps the lowest British tender was fifth on the list, and its acceptance would have meant a preference of 68.6 per cent. Lamps made in Holland were accepted.

" Although a tender for British lamps was second lowest in the case of the supply of 2,000 750-watt lamps, the preference amounted to 45.7 per cent., and this was considered too high by the aldermen. Lamps manufactured in Holland were again purchased."

Belgium.—The Société des Ateliers de Constructions Electriques, of Charleroi, has secured a contract for electrically-operated pumps for the waterworks of the municipal authorities of Gembloux.

In addition to home concerns, Dutch, Danish, and French manufacturers submitted tenders on January 9th to the Belgian State Railway authorities for the supply of electric cables. For the contract for 2,000 metres of twin-conductor armoured cable, the lowest offer was that of the Société des Ateliers de Constructions Electriques, of Charleroi; for 3,000 metres of lead-cased copper wire, the tender of the Société de la Manufacture de Cables Electriques, of Eupen, was accepted.

Dumfries.—Town Council. Accepted.

Installing electric lighting at 40 houses (£192).—Whyte, Thomson & Co., Ltd.

London.—ST. MARYLEBONE.—Electric Supply Committee.—With further reference to our note on p. 106 of the ELECTRICAL REVIEW of January 11th for free wiring the block of dwellings at Wharncliffe Gardens. The property contains 180 two-room, 180 three-room and 180 four-room tenements, and 43 staircase circuits. The following are the particulars of the tenders received :—

Tenderer.	Tenements. £	Staircases. £	Work to be completed.
Franklin & Son	4,196	493	32 weeks.
Grant & Taylor	3,988	552	18 "
G. Hopkins & Sons	3,825	422	56 "
H. E. Keen & Co.	3,612	344	20 "
Mann, Egerton & Co.	3,376	442	25 "
Ridout & Ratcliff	3,169	460	as required.
Electric Installations, Ltd. ...	2,794	371	26 weeks.
Locke & Soares	2,599	443	15 "
H. J. Cash & Co., Ltd. ...	2,293	282	12 "
Francis Polden & Co., Ltd. ...	2,290	390	10-12 weeks.
Electric Productions Co., Ltd.	2,254	365	—
Hewson & Lown	2,171	383	22 weeks.
Symper & Everahed. (Recommended.)	2,058	415	12 "

METROPOLITAN ASYLUMS BOARD.—The Board at its meeting in December accepted a tender from the Guild of Engineers (London), Ltd., at £153, for alterations and extensions of electric lighting and power installations in the new kitchen at Tooting Bec Mental Hospital. (See ELECTRICAL REVIEW, December 21st, 1923, p. 942.) The company has since stated that there has been an omission in its tender, and asks to be allowed to increase it to £209. The Works Committee is unable to recommend that its request should be acceded to, and is of opinion that the next lowest tender, that of Myall Bros., at £228, be accepted.

ST. PANCRAS.—Electricity and Public Lighting Committee.

One set of turbine internals to fit either of the 3,000-kW sets (£2,307).—Brush Electrical Engineering Co., Ltd. (Recommended.)

Condensing-water pump at King's Road station (£1,680).—Rees Roturbo Co., Ltd. (Recommended.)

Steam turbine boiler feed pump at King's Road Station (£419, plus £13 for spare parts).—Rees Roturbo Co., Ltd. (Recommended.)

STEPNEY.—Electricity Supply Committee.

Air compressor for Mile End sub-station (£101).—Reavell & Co. (Accepted.)

Supply of fuse boxes during 1924 (£1,450).—W. T. Henley's Telegraph Works Co., Ltd. (Recommended.)

STOKE NEWINGTON.—Elecric Lighting Committee.

The undermentioned tenders were received for the plant extensions. (See ELEC. REV., January 18th, 1924, p. 106):—

Converter plant (two machines).

	750 Rev. £	600 Rev. £	500 Rev. £	
Bruce Peebles & Co., Ltd. (motor converters)	7,320	—	**8,470**	(Recommended.)
Mather & Platt, Ltd. (rotary converters)	7,384	7,922	—	
General Electric Co., Ltd. (rotary converters) ...	7,677	8,234	8,886 (rotary converter) 8,467 (motor do.)	
British Thomson-Houston Co., Ltd. (rotary converters) ...	7,749	8,311	—	
English Electric Co., Ltd. (rotary converters) ...	7,098	8,542	—	
Metropolitan-Vickers Electrical Co., Ltd. (rotary converters)	8,250	—	8,760	

Switchgear.

General Electric Co., Ltd. (Recommended.)	**£2,330**
Bertram Thomas	2,455
Switchgear & Cowans, Ltd.	2,705
British Thomson-Houston Co., Ltd.	2,750
Ferguson Pailin, Ltd.	2,751
Metropolitan-Vickers Electrical Co., Ltd.	3,248
English Electric Co., Ltd.	3,719

Feeder and distributor mains.

W. T. Henley's Telegraph Works Co., Ltd. (Recommended.)	**£8,503**
Johnson & Phillips, Ltd.	8,649
Callender's Cable & Construction Co., Ltd.	8,797
Enfield Cable Works, Ltd.	8,804
Siemens Bros. & Co., Ltd.	9,627

Richmond-on-Thames.—The Town Council. Accepted:—

Installing electric light, waterworks engine room.—A. Hayes (Richmond Electric Installations).

Duplicate electrically-driven h.p. pump (£125).—Worthington, Simpson, Ltd.

Staveley.—The Electric Supply Co., of Chesterfield, has secured the contract for installing electricity at 50 houses at Staveley.

Taunton.—Town Council. Accepted:—

Two steam turbine sets, combined a.c. and d.c., at £6,889 per set.—Richardsons, Westgarth & Co.

Forthcoming Events.

Birmingham and District Electric Club.—Friday, January 25th. At the Grand Hotel, Colmore Row. At 7 p.m. Presidential address by Mr. W. Shaw.

Junior Institution of Engineers.—Friday, January 25th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecture on "Molecular Attraction and its Relation to Engineering," by Prof. E. Edser. Friday, February 1st. Lecturette, "Torsion Meters," by Mr. J. Ward.

(North-Western Section).—Monday, January 28th. At the Textile Institute, Manchester. At 7.30 p.m. Paper on "Some Developments in Electricity Supply," by Mr. S. L. Pearce, chief engineer and manager, Manchester Corporation Electricity Department.

Greenock Association of Electrical Engineers.—Wednesday, January 30th. At 22, West Stewart Street. At 7.45 p.m. Electro-medical demonstration.

Electrical Power Engineers' Association (Derby and District Section).—Wednesday, January 30th. At the Technical College, Derby. At 7 p.m. Lecture on "Combustion and Boiler House Efficiency," by Mr. J. N. Waite.

(Southern Division).—Friday, February 1st. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 7 p.m. Lecture on "Recent Developments in Electric Control," by Dr. C. C. Garrard.

Institution of Electrical Engineers.—Thursday, January 31st. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "Some Researches on the Safe Use of Electricity in Coal Mines," by Prof. W. M. Thornton.

(North-Eastern Centre).—Monday, January 28th. At Armstrong College, Newcastle-on-Tyne. At 7.30 p.m. Ordinary meeting.

(East-Midland Sub-Centre).—Tuesday, January 29th. At Loughborough College. At 6.45 p.m. Paper on "Pulverised Fuel and Efficient Steam Generation," by Mr. D. Brownlie.

STUDENTS' MEETING.—Friday, January 25th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Paper on "Alternating Current Bridge Measurements," by Mr. A. Serner.

(Mersey and North Wales (Liverpool) Centre).—Friday, January 25th. At the University Club, Mount Pleasant, Liverpool. At 7 p.m. Annual dinner.

(North Midland Students' Section).—Tuesday, January 29th. At the University, Leeds. At 7 p.m. Paper on "The Electrical Equipment on Railways," by Mr. V. Mitchell.

(South Midland Centre).—Wednesday, January 30th. At the University, Birmingham. At 7 p.m. Ordinary meeting.

Edinburgh Electrical Society.—Friday, February 1st. At 4, Queen Street. At 8 p.m. Discussion night.

Royal Institution of Great Britain.—Friday, February 1st. At 21, Albemarle Street, S.W. At 9 p.m. Lecture on "Recent Research on Crystalline Structure," by Sir William Bragg, F.R.S.

Notes.

Local Society.—A meeting of the West of Scotland branch of the Association of Mining Electrical Engineers was held on January 16th in the Royal Technical College, Glasgow, Mr. David Martin (chairman of the branch) presiding. The president of the Association (Mr. W. T. Anderson) delivered an address dealing with the organisation and work of the Society. Afterwards Mr. J. Laird (of Carron Company) read a paper on "Hauling Gear in Mines," dealing only with electric hauling, and describing in detail the methods employed in the different operations.

Reorganisation of Aeronautical Research.—The Air Ministry announces a reorganisation of the arrangements for the control of aeronautical research. As from April next the control of one side of the work will be transferred to a Director of Scientific Research, while the other side will be assigned to a Director of Technical Development, and the appointment of Director of Research will then lapse. The new directors will both serve under the Air Member for Supply and Research. Appointments to the new posts will be announced in due course.

Strike of Locomotive Drivers.—At the time of going to press a strike of the members of the Associated Society of Locomotive Engineers and Firemen is in progress, it having started at 12.30 a.m. on Monday. As a result, the railway traffic facilities of the country are much disorganised, and millions of people are suffering inconvenience.

The Development Commission.—The thirteenth report of the Development Commissioners, covering the year ended March 31st, 1923 (Stationery Office, 4s. net), does not indicate how electro-culture experiments proceeded during the year. There is a bare statement that the Imperial College of Science and Technology received a grant of £1,135 for this work. In a note on the Hereford rural electricity scheme, the Commissioners refer to the prosecution and conviction of the engineer in charge for serious defalcations, and state that an inquiry conducted by the Electricity Commissioners showed that the accounts were loosely kept, and that the organisation of the rural side of the power service was gravely defective in many respects. They add: "Until complete information has been received no definite statement can be made as to any loss which may fall on the Development Fund, but it is to be feared that the hopes entertained that the scheme would afford a demonstration of the practicability and utility of an agricultural electric service must be abandoned, at any rate, for a time. The Commissioners deeply regret the failure of a project which appeared to offer promise of such great usefulness, and they trust that some other electric power undertaking may be found to make special arrangements for embarking on an agricultural and rural industries service."

Municipal Electrical "Old Stagers."—The second biennial dinner and reunion of the Municipal Electrical Old Stagers took place on Thursday evening, January 17th, at the Hotel Cecil. Fifty-one attended, including five guests, namely: Mr. H. Booth, Electricity Commissioner; Mr. S. E. Britton, President of the I.M.E.A.; Dr. S. Z. de Ferranti; Sir Harry Haward, Electricity Commissioner; and Mr. S. L. Pearce, C.B.E.

As far as possible it is intended that the past-presidents of the I.M.E.A., in the order of date of their holding that office, should preside at successive reunions, and accordingly Mr. C. H. Wordingham, C.B.E., was in the chair on this occasion, he having been president of the M.E.A. at the Manchester Convention in 1897.

Considerable thought had been given to the menu card, on which were two illustrations, which Mr. Hughman had kindly had made for the occasion. One showed the original 100- and 240-kW belt-driven sets at Dickinson Street Station (Manchester), and the other the 35,000-kW sets at Barton, which have just been erected. Ample space was left for the autographs of those present, and at the top of one of the pages reserved for this purpose was a cameo of the chairman in high relief. The die was made by a new process invented by the son of one of the earliest pioneers in the electrical industry, Mr. Henry Edmunds. By photographic means a plaster medallion in any desired height of relief is made, and from this a bronze one is produced. This is then reduced in an ordinary copying machine to a size suitable for the required die. This invention is not yet on the market, and those present greatly appreciated Mr. Edmunds's kindness in providing the die.

There was only one toast in addition to the loyal ones, namely, "The Municipal Electrical Old Stagers," which was proposed by Dr. S. Z. de Ferranti with his usual originality and felicity. The speech was of an unusually intimate character, and was highly appreciated by all who heard it. The chairman, responding, briefly recalled the proceedings at the first Convention, and referred to the views expressed at that time of some of the Old Stagers present. He concluded with a brief account of the process by which the cameo referred to above was made.

Mr. H. Faraday Proctor also responded, and at the same time informally proposed the health of the chairman, who had also acted as hon. secretary of the reunion.

At the conclusion of the dinner a flash-light photograph of a group of those present was taken without the usual accompaniment of bottles, table cloths and débris. The poison gas arising from the flash-light was left behind in the dining room and all adjourned to another room, where the rest of the evening was spent in pleasant chats among old friends. There was provided a small and very interesting collection of photographs of early stations and other historical objects, as well as a sprinkling of antique switches, lamp-holders, &c., all of which were contributed by Old Stagers.

The usual features of a reunion so ably depicted by Fougasse in the current number of *Punch* were avoided, and the enjoyment of all was greatly enhanced by the deliberate omission of any official attempt to amuse them.

Inquest.—The Shipley coroner returned a verdict of "death from natural causes" at an inquest, on January 18th, on the body of Albert Alderson (48), of 5, Castle Street, Shipley, who died with tragic suddenness after being found unconscious at his work at the Shipley District Council electricity station. He had felt pain in the side and was advised to ask to be relieved, but replied: "I'll try to carry on." Medical evidence was given that death was due to heart failure, accelerated by commencing pneumonia and lung trouble, and the Coroner, in giving his verdict, commented that the deceased "had been too conscientious a workman; he wanted to carry on when he ought to have rested."

Shop-window Lighting. — The Incorporated Sales Managers' Association visited the Lighting Service Department demonstration rooms of the British Thomson-Houston Co., Ltd., on January 7th, to hear an address and witness a demonstration of lighting effects as applied to shops and show windows. The proceedings were conducted by Mr. W. E. Bush, who dealt with the evolution of lighting and compared old and modern methods of illumination. Mr. Bush said that it paid the shopkeeper to use light of high intensity, since it assisted customers in the selection of merchandise. It should not be necessary, as was the usual occurrence to-day, for a customer to have to walk to the nearest light in order that some idea could be obtained of the texture or quality of an article. Some shops were located in such positions that even in broad daylight very little illumination was available in the shop; in such shops it would pay to use artificial light during the whole of the day. Customers disliked gloomy shops and always went shopping where the light intensity was high.

By means of lantern slides Mr. Bush compared actual tests carried out on four shop windows and then showed lighting effects, including spot lighting in a model shop window, and demonstrated the effect of colour in enhancing the efficiency of a display. Some original colour effects were shown, including colour mixing by means of specially-designed apparatus, the three primary colours—red, blue and green—being automatically mixed in continually changing quantities. The colour demonstration is an entirely new development of the Lighting Service Department, and this is the first occasion on which it has been shown.

Power Factor Competition.—As we go to Press we learn from Mr. S. T. Allen, M.I.E.E., adjudicator in the competition instituted by the Electrical Apparatus Co., Ltd., for the best non-technical explanation of "Power Factor," that the following were the prize winners:—

W. R. Cox	£2 10 0	J. G. Griffin	£1 12 6
C. Turnbull	2 10 0	L. H. Dalton	1 12 6
R. H. Rawll	2 10 0	W. A. Reid	1 0 0
R. D. Reynolds	1 12 6	L. S. Wallis	1 0 0
W. S. Jordan	1 12 6	G. K. Fletcher	1 0 0

Mr. Allen states that there was a large number of entries, and in judging the essays he tried to place himself in the position of the non-technical proprietor or manager of an average business, who might find himself confronted with the subject of power factor. Many excellent explanations were too technical to score, and two which were amongst the best, but were not submitted for competition, were found to emanate from Mr. Amberton himself. The best replies will be published later. In Mr. Allen's view the competition has been of enormous value.

Another X-ray Martyr.—Mr. Thomas John Oliver, who was first electrician and photographer on the staff of the Leeds General Infirmary, and then, in 1897, organised an X-ray department, became a martyr in the pursuit of his work. His right hand first became affected, X-ray dermatitis developing. His left arm, too, became seriously affected, and an excision in his left elbow was necessary. In spite of that he carried on until in 1911 his right arm became so seriously involved that it had to be amputated. Soon afterwards he retired from the Infirmary on a pension, and his health improved for a time, but later cancer of the upper lip, due to the same cause, developed. His case was brought to the notice of the Carnegie Trust, who, in recognition of the self-sacrificing spirit he had shown, granted him a pension, but his condition became more serious, and he died on January 4th.—*Leeds Mercury.*

New X-rays Claim.—A method by which X-ray photographs can be taken of the veins and arteries in the living body is reported to have been discovered by Dr. J. Berberich and Dr. S. Hirsch, of Frankfort-on-Main. Hitherto the contrast between the blood and the surrounding tissues in the living body has been too slight to produce distinctive shadows on the X-ray plate. The Frankfort doctors, by injecting a harmless salt of strontium into the blood-vessels, claim to produce such strong shadows that the most minute ramifications of the veins and arteries can be seen.—*Daily Mail.*

Aircraft Leader Cable.—The French Government has decided to make financial provision for laying 700 miles of special electrical cabling on the system devised by M. William Loth for guiding aeroplanes in flight (see ELECTRICAL REVIEW, December 21st, 1923; page 951). The three commercial airlines to be "electrified" are Paris-London, Paris-Brussels, and Paris-Strasburg. Work has already begun on the route from the Paris air-port to the Channel followed on the London flight.—*Daily Mail.*

Light and Disease.—The possibilities of light treatment for foot-and-mouth cattle disease were recently discussed in a letter to *The Daily Mail* from Lord Clifford of Chudleigh. He says: "For many years I have been studying the action of coloured light upon the growth of vegetation and crops, and I offer the suggestion that one—if not the most potent—of the predisposing causes of the present outbreak is the great lack of afternoon sunshine that has been experienced during the past year in many parts of England. From my experience as a practical farmer I am inclined to the opinion that the result of the sunless afternoons has been the stimulation of the growth of bacteria, or the development of acidity in plants—whichever it is—that in animals produces or encourages the susceptibility to the attack of the disease. I am of the opinion that in the treatment by properly applied coloured electric light, we have a more potent means of preventing, combating, and curing disease than by the use of sunlight itself. If for an hour or two each day the affected cattle were enclosed in a barn, artificially illuminated by red and orange electric light, the beneficial effects towards rapid recovery would probably be increased tenfold."

Socialism.—We have received a copy of the 41st annual report (1923) of the Liberty and Property Defence League. It deals chiefly with the need for greater efforts to combat socialism in view of the present political situation and states the necessity for the League to receive added support to enable it to extend its operations.

Power Transmission by Radio.—The latest developments in respect of the transmission of power by wireless are rather astonishing, and to the uninitiated may even sound fantastic. It appears that M. Léon Bouthillon, chief engineer of the French Government Telegraph Service, has recently concluded a series of experiments, the results of which have not yet been made public. His schemes are based on an idea which is not unfamiliar, that is, making the earth oscillate at its natural frequency. This frequency has been calculated at six cycles per second, a wave length of some 31,000 miles. It is anticipated that in the future it will be possible to erect huge power stations at such points as the Niagara Falls or the unused falls of Central Africa and feed their energy into the oscillating earth in the form of electrical currents of six-cycles frequency. Tuned receivers could then extract the energy anywhere on the face of the earth and convert it into any form of current required.—*Daily Mail.*

Launch of "Minnetonka."—Messrs. Harland & Wolff, Ltd., have successfully launched from their Belfast Yard the first-class passenger liner *Minnetonka*, of about 21,400 tons, for the Atlantic Transport Co., Ltd. The new vessel is 625 ft. by 80 ft. by 53 ft. 6 in. First-class passengers only will be carried, and the electrical installation consists of four 400-kW direct-current generators, each coupled direct to a steam turbine. The dynamos run in parallel at 220 volts. In addition, there is one 75-kW dynamo direct coupled to a Diesel engine, situated well above the water line. There will be considerably over 2,000 lights installed on the vessel, in addition to a considerable number of motors and other electrically-driven apparatus, including no less than 36 electrically-driven winches, two boat winches, sounding machine, refrigerating machinery and service machinery comprising the following:—Dough mixer, dish washer, potato peelers, knife cleaner, and printing machine. The steering gear is of the Wilson-Pirrie duplex type, with auxiliary steering gear (also electrically operated) as a stand-by. The electric cooking apparatus includes a baker's oven, a large salamander, griddle plates and toasters, and the dumb waiters in the saloon are also electrically heated. The water-tight doors are of Harland & Wolff's electrically-operated type, and are capable of all being controlled simultaneously from the captain's bridge, where indicators are fitted to show the position of each individual door. Warning bells are also fitted at each door, which ring automatically before the doors are closed from the navigating bridge. The clocks throughout the ship are electrically operated from a master clock in the chart room. There is also a very complete loud-speaking telephone installation from the bridge to various parts of the ship for navigating purposes, and there is an ordinary telephone system in connection with the engineers' and stewards' rooms. The propelling machinery consists of a two-shaft arrangement of Brown Curtis geared turbines. The auxiliary machinery is steam and electrically driven.

Appointments Vacant.—Instrument mechanic, for the Rawtenstall Corporation Electricity Department; engineer, with special experience in automatic telephone exchange equipment and traffic problems, for the Irish Free State G.P.O.; plumber-jointer, for the Swansea Corporation Electricity Department. (See our advertisement pages this week.)

A German Electricity Works' Capital.—The paper securities of the Mannheim Power Works Co. have just been introduced on the Berlin Stock Exchange, as follows: 600 million marks in 10 per cent. cumulative preference shares, 900 millions in 15 per cent. cumulative preference shares, a coal value loan of the value of 150,000 tons of coal, 92.25 millions in 5 per cent. debentures of the year 1921, and 61.9 millions in 5 per cent. debentures of 1922. In addition the ordinary share capital stands at 300 millions of marks. After such figures, it is significant to hear that the undertaking is projected for only 37,500 kW, of which 25,000 kW is already in use.

Service Notes.—The following improvements in the scales of pay have been approved by the Admiralty for stokers employed in electrical generating stations in home dockyards and other civil establishments, with effect from the first pay-week following January 11th, the first-mentioned figures in each case referring to the six-day rate and the second to the nominal weekly rate for seven shifts:—

Assistant stoker or stokers on probation: 27s. to 30s., and 31s. 6d. to 35s.

Stokers: 31s. to 34s., and 36s. 2d. to 39s. 8d.

Leading Stokers: 35s. to 37s., and 40s. 10d. to 43s. 2d.

Men in receipt of more than the new minimum rates of pay are not entitled to any immediate improvement under the new scales.

Accident.—LOUGHREA (IRELAND).—Returning home at midnight, a man named O'Donoghue came in contact with electric wires which had been blown down by the storm. His cries attracted persons who had him conveyed to the local hospital, where it was found he was badly burned. His condition is precarious.

Fatality.—Joseph Howes (17) was killed at the Sheffield works of Messrs. Jonas & Colver during the night of January 17th. According to the *Sheffield Independent* the lad was carrying a metal rake, with which he intended to rake out a fire. The rake came in contact with a "live" wire, and he thus received a 200-volt shock. Artificial respiration was applied, but when a doctor arrived he pronounced Howes to be dead.

The Electrical Trades Benevolent Institution.—We have received from Mr. F. B. O. Hawes, A.M.Inst.C.E., M.I.E.E. hon. secretary of the E.T.B.I., a list giving the final results of the collection in connection with the 1923 Festival, showing that the amount collected was £1,350 10s. Some additional amounts received in connection with the appeal of Sir Philip Nash, President of the Festival, since the list was printed bring up the total to £1,389 8s. 6d. The Chairman's list amounted to £710 11s. 6d.; Mr. J. Y. Fletcher's (chairman of committee) to £110 15s.; Mr. F. E. Chard's to £64 5s. 6d.; Capt. J. N. Stephens's to £35 8s. 6d.; Mr. C. Wilson's to £59 1s. 6d.; and Mr. E. Wilson's to £58 11s. The Manchester and District Local Advisory Committee sent £38 18s., Cardiff Committee £21 9s. 6d., and Newcastle-on-Tyne Committee £6 6s.

Mr. Hawes informs us that he has received a P.O. for 10s. from Wandsworth, without the name or address of the donor.

Electricity in the Home.—On Wednesday evening, January 30th, under the auspices of the Hackney and Stoke Newington Chamber of Commerce, Alderman Mrs. Hammer, Mayoress of Hackney, will lecture on "Hackney Electricity in the Home," with demonstrations, lantern slides, &c.

Radio Research.—The Derby Wireless Club is inviting the Radio Society of Great Britain to raise a fund for radio research, particularly into the possibility of television. The proposal is that each holder of a licence should be invited to contribute one shilling for financing the investigations.—*Manchester Guardian.*

Electro-Farming.—A CORRECTION.—In the article by Mr. R. Borlase Matthews, which was published in our issue of December 7th, 1923, on "The Position in the Netherlands," the heading which appeared over the table on p. 850 should have been attached to the table on p. 849, and should have read: "Capacity of Electromotors in h.p. installed," &c.

Globular Lightning.—Writing to *Nature* of January 19th, on the subject of globular lightning, Mr. G. C. Simpson, of the Meteorological Office, refers to the suggestion of Mr. E. Kilburn Scott that the ball may be a mass of concentrated nitrogen oxides. A similar suggestion was made in the *Philosophical Magazine*, Volume xxi, p. 630, by Mr. Thornton, but he suggested that the ball was composed of ozone. "Now, the difficulty with all such explanations is to understand how the ball is held together. If the light given off is caused by chemical combination, the temperature of the gas in the ball must be very high, and this would accelerate the natural mixing which takes place when a mass of gas is introduced into an atmosphere of another gas. I am unable to imagine any process by which a mass of hot glowing gas can hold together except in some form of vortex ring or whirl as suggested by Sir Oliver Lodge. But I know of no evidence to indicate such a whirl, nor can I conceive how it could be formed, while there is good evidence that the ball of globular lightning has not the nature of a flame."

Fatal Boiler Explosion in South Africa.—Whilst one of the boilers in the new electric power station at Brandfort, Orange Free State, was being tested, it exploded, causing injuries to nine persons. Our Cape Town correspondent states that four of them were seriously injured, and were removed to the National Hospital at Bloemfontein. The next day, one of the injured, Mr. P. Strydom, the contractor for the building, died, and subsequently Mr. H. James, representative of the Griffin Engineering Co., Ltd., and also Mr. J. Hooper (who was looking on at the time of the accident) have also died.

Electricity-resisting Yarn.—The Federation of Master Cotton Spinners' Associations has just issued a circular relative to electricity-resisting yarn. It appears that an important discovery has been made by the British Cotton Industries Research Association. Comparisons have been made of the electrical resistivity of yarns produced in Lancashire with the most non-conductive yarn produced in Germany, and it has been proved that the English yarn can be prepared so that it will possess far greater powers of resistance than any of foreign manufacture. The British Electrical and Allied Industries Association has asked those firms which are willing to supply them with these prepared yarns to send their names and addresses to the Federation, so that a list may be sent to the members of the Association.

Mercury for Emmet Boilers.—In an article in *Power* a writer expresses a doubt as to whether sufficient mercury is produced to permit the extensive use of the Emmet mercury boiler (described in our issue of December 28th, p. 993). He draws attention to the fact that only 478,000 lb. of mercury was produced in the United States in 1922. The Emmet boiler of the size installed at Hartford requires 30,000 lb., and so it will be seen that such a production would only cater for 16 boilers of this size (1,500 kW). The world production of mercury in 1921 was 4,451,000 lb.; on the same basis as before, only 148 boilers could be provided for by this quantity. The writer says that the development of the system may lead to an increased production of mercury, but sounds the warning that prices will commence to soar to unheard-of heights.

Institution Notes.

Institution of Electrical Engineers.—A.M.I.E.E. EXAMINATION.—The next examination will be held on April 3rd, 4th and 5th. Candidates must be either Students or Graduates of the Institution or have lodged with the secretary a duly completed form "E" for election as Associate Member. Entry forms for the examination, which must be completed and returned by March 1st, and particulars regarding election to membership of the Institution may be had on application to the Secretary, Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C.2. The examination is being held this year about a fortnight earlier than in past years in order that those successful candidates who have qualified in other respects for Associate Membership may be elected before the session is over.

The annual dinner is to be held on Thursday, February 21st, at the Hotel Cecil.

INFORMAL MEETING.—With reference to the meeting held on January 7th, reported on p. 108 of our last issue, we are informed that the statement that Mr. F. Selley had remarked during the discussion that there were over 3,000 cookers installed in St. Marylebone is incorrect; it should read, "3,000 pieces of domestic apparatus."

Institution of Engineers (India).—This Institution has arranged the programme for the fourth annual general meeting which will be held in Calcutta during the first week of February. Mr. C. D. M. Hindley, Chief Commissioner of Railways, president for the year 1924-25, will preside at the meeting and the annual dinner. A number of papers will be read, among which will be an elucidation of Einstein's theory of relativity, by Mr. D. G. Harris (Deputy Secretary to the Government of India, Public Works Department), a valuable paper on the new Indian boiler regulations, by Mr. D. R. MacIntosh (Chief Inspector of Steam Boilers and Smoke Nuisances, Bombay Presidency), and a paper on the congestion of Calcutta, by Mr. T. A. F. Stone (District Locomotive Superintendent, N.W. Railway), which will be of particular interest, not only to engineers, but to the public in general. Visits will be made to the Government test house, Alipore, the King George's dock, the Cossipore power station of the Calcutta Electric Supply Corporation, and other modern plant.—*Indian Engineering.*

Institute of Transport.—In the course of an interesting paper on "Passenger Transportation in Industrial Areas," read at a Manchester meeting of the Institute on January 16th, Mr. Henry Mattinson, the general manager of the Manchester Corporation Tramways, suggested that the tramcar was still the best and most economic vehicle for dealing with passenger traffic in our congested city areas. Mr. Mattinson's paper was read by proxy, as he himself was unable to be present.—*Manchester Guardian.*

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

The marriage took place, on January 7th, at Wollaston Parish Church, of Mr. ARTHUR ROLAND WOODHALL, A.M.I.E.E., and Miss BEATRICE M. DARBY, of Stourbridge.

Notifying the change of his telephone number to "City 7854," Mr. W. WORBY BEAUMONT points out that the new number allotted to him is an appropriate one, being π (omitting the decimal point).

Mr. A. GRIPPER, of the North Metropolitan Electric Supply Co., has been appointed mains assistant to the Croydon Corporation electricity department.

Mr. H. P. STOKES, tramway manager to the Plymouth Corporation, recently met with a mishap which will prevent him from resuming work for some time. He fell into an inspection pit at the tramway depôt, a drop of about six feet, and injured his leg.

Dumfries Town Council has appointed Mr. W. R. MACAULAY, of Burnock, as electrician for the ensuing year.

Mr. H. G. CARTER, assistant electrical engineer of the Sydney (N.S.W.) State Railway and Tramway Department, was recently appointed State electrical engineer, in succession to Mr. W. Corin, who had resigned in order to take up private practice.

Mr. W. B. PICKERING, a director of Hadfields, Ltd., of Sheffield, arrived in Melbourne early in December in connection with the business affairs of that company and of Hadfield's (Australasia), Ltd.

The Kirkcaldy Council has before it an application from Mr. FRANCIS, chief electrical engineer, for an increase in his salary, which is £608 per annum, with no pension. He points out that in practically all similar power stations in Great Britain the salary of the chief electrical engineer is regulated in accordance with the minimum scale of salaries for such, though in most of the larger towns the salaries actually paid exceed that of the scale. This scale being based on output, Mr. Francis says, in accordance with it his salary should now be £805 per annum on last year's output, with the addition in the future of £15 per annum for every further half million units of electricity sold, and this apart from any additional remuneration which may be paid him as tramway manager. He further points out that his present salary is little more than that paid to junior engineers and mains superintendents in similar undertakings, and considerably less than junior engineers are receiving in any of the larger power stations, and where officials are entitled to pensions after 20 years' service. Mr. Francis has served the Corporation for 21 years. The application is being considered.

Lieut.-Colonel NORMAN HARRISON, C.M.G., D.S.O., M.I.E.E., who retired last November from the Under-Secretaryship, Department of Posts and Telegraphs of the Union of South Africa, and who, for many years previous, was engineer-in-chief, has joined the directorate of the Western Electric Company, Ltd., and will shortly return to South Africa to take up residence there in the interests of the company. Colonel Harrison, who has had a distinguished career in the Public Service in South Africa, received his first appointment under the Natal Government, holding the position of assistant engineer of telegraphs and telephones in Natal for some years. He was transferred in 1903 to a similar post in the Transvaal service. In 1905 he received promotion to the post of engineer, and, in 1908, to the chief engineership, while eventually, at the inauguration of the Union, Colonel Harrison was selected for the position of engineer-in-chief of the Union. At the commencement of the Great War, Colonel (then Major) Harrison joined the Defence Department as Director of Signals. In 1915 he left for Europe as officer-in-command of the South African Signallers' Company. This company, on arrival in England, was attached to the Royal Engineers, joining the XV Corps in France in 1916. In addition to his command of the Company, Major Harrison held the appointment of Assistant Director of Army Signals. His service during the first battle of the Somme was recognised by his being promoted to the rank of Lieut.-Colonel and the bestowal of the Distinguished Service Order. Later he was decorated with the Commandership of St. Michael and St. George and the Croix de Guerre. He was mentioned in dispatches three times. In 1921 Colonel Harrison was appointed Under-Secretary in the Posts and Telegraphs, and during his period of service has travelled extensively in Europe, America and Canada, in which countries he studied telegraphic and telephonic problems.

The Keighley Corporation's Salaries Committee recommends that, subject to the scheme for the substitution of trolley vehicles for the tramways being proceeded with within a reasonable period and the manager undertaking not to apply for another situation until the change-over is completed, he be paid an honorarium of £100 when the first new trolley vehicle is put into service and runs satisfactorily, and an additional honorarium of £100 when the scheme is completed.

At a meeting of the directors of the Dublin United Tramways Co., Ltd., last week, Mr. JOSEPH MOONEY, of Cabra Lodge, Dublin, was appointed chairman of the company in succession to the late Right Hon. Laurence Waldron.

On January 15th the Railway Electrical and Telegraph Engineers and a few personal friends entertained Mr. GEORGE RUSSELL, M.I.E.E., telegraph engineer, G. & S.W. Railway, Glasgow, to dinner at Euston Hotel, and presented him with a gold watch and chain suitably inscribed. Mr. Thorrowgood, of the Southern Railway, presided, and in making the presentation, spoke in high terms of Mr. Russell's abilities and a readiness at all times to assist his colleagues, and wished him happiness in his retirement.

Obituary.—MR. J. HOLLOWAY.—The death occurred on January 3rd of Mr. James Holloway, who was associated with Edison for some years. Mr. Holloway superintended, in 1883, some of the first electric lighting installations in this country. At the last meeting of the Edison "pioneers" he was stated to be the oldest of the number living. He was 84 years of age.

MR. E. W. WHITEHEAD.—The death took place on January 10th of Mr. Ernest William Whitehead, partner in the firm of Whitehead Bros., electrical engineers, of Hill Road, Wimbledon. He was 57 years of age.

MR. G. CLAPPERTON.—With reference to the death of Mr. George Clapperton, vice-president, traffic manager, and director of the Commercial Cable Company, which was announced here last week, we learn that he passed away suddenly on January 11th, at St. Luke's Hospital, following an operation. Mr. Clapperton entered hospital last month to be treated for a minor ailment, and was to leave the institution on Wednesday last week. That morning he was stricken with an acute attack of appendicitis, and was operated upon a short time later. Mr. Clapperton had been connected with the Commercial Cable Company for forty years, having joined the service in April, 1884, as superintendent in New York. Through his practical and varied experience in the field of telegraphy and through his business acumen, he rose to the vice-presidency. He was born in England in 1854, and began his career of telegraphy at the age of fourteen. In 1874 he was sent to America by the Direct United States Cable Company as an operator, and remained with it until 1882. For the next two years he was in the employ of the Western Union Telegraph Company at Canso, Nova Scotia, from which he went to the Commercial Cable Company. Mr. Clapperton was a bachelor. He was a member of the Institution of Electrical Engineers of England, New York Chamber of Commerce, the Pilgrims Society, St. George's Society, St. Andrew's Society, St. Andrew's Golf Club, Engineers' Club, Blooming, Hunting, Fishing, and the Hardware Clubs. He was a naturalised American.

MR. A. C. GOODMAN.—We regret to learn that Mr. Arthur C. Goodman, of Messrs. G. H. Stevens & Co., who was many years with the A.E.G. as supervising engineer, and during the war was attached to the engineering staff at Woolwich Arsenal, passed away on January 4th, after a long and painful illness.

SIR A. D. REID.—We regret to read that Sir Archibald Douglas Reid, K.B.E., C.M.G., who for many years devoted himself to X-ray work, has passed away at the early age of 52 years. His death occurred in Switzerland on January 15th, and, according to the *Times*, he has paid the penalty for his devotion to specialisation in X-ray work, in impaired health for some time past. Our contemporary states that he qualified as M.R.C.S., L.R.C.P., in 1901, and in 1920 took the diploma in medical radiology and electrology at Cambridge. "During the war he rendered useful service as president of the War Office X-ray Committee, and was created C.M.G. in 1917 and K.B.E. in 1919. In 1911-12 he was president of the Electrotherapeutic Section of the Royal Society of Medicine. At his death he was superintendent of the Radiological Department of St. Thomas's Hospital, and he was at different times radiologist of the Royal Westminster Ophthalmic Hospital and the Evelina and Paddington Green Hospitals for Children, medical officer in charge of the Electrical Department of King's College Hospital, and consulting radiologist of the Queen Alexandra Military Hospital, Millbank, the Royal National Hospital for Consumption, Ventnor, and the Cray Valley Hospital. In 1920-21 he was president of the Society of Radiologists, and he was also joint secretary of the Radiology Section of the International Congress of Medicine, and hon. member of the American Röntgen Ray Society."

HERR ALFRED BENACK.—The death is announced from Berlin, at the age of 59 years, of Herr Alfred Benack, chief engineer of the Siemens-Schuckert Werke in that city, and one of the pioneers of electric tramways in Germany.

MR. T. W. GREAVES.—The death took place suddenly, on January 11th, of Mr. Thomas William Greaves, Dorney House, Thames Street, Weybridge, managing director of the Wholesale Electrical Company (1922), Ltd., Baker Street, Weybridge. He was 45 years of age, and was a founder and a Past Master of the Kelvin Lodge of Freemasons, London.

New Companies Registered.

Safety First Engineering Co. (194,961).—Private company. Registered January 6th. Capital, £2,000 in 4,000 ordinary shares of 5s. and 1,000 preference shares of £1. To take over the business of manufacturers of hydraulic rock-busters, rock drills and electric safety lamps for testing gas, carried on by L. Williams and V. L. Williams, of Pentwyn Works, Aberbeeg, Mon. The first directors are:—L. Williams, Pentwyn, Aberbeeg, mechanical engineer; V. L. Williams, Pentwyn, Aberbeeg, mechanical engineer (joint managing directors, with £5 each per week as remuneration). Registered office: Pentwyn Cottage, Aberbeeg, Mon.

Young & Co. (Hants.), Ltd. (195,043).—Private company. Registered January 11th. Capital, £2,500 in £1 shares. To acquire the business of a manufacturer of and dealer in radio supplies now carried on by J. Young at 186, Above Bar Street, Southampton, as "Young & Co." The permanent directors are.—J. Young, A.M.I.E.E., Clarence House, Belmont Road, Southampton; H. A. Sugden, Liplands, Wimborne, Dorset. Qualification, £20 shares. Solicitors: C. C. Dominy, 17, Portland Terrace, Southampton.

Norton Electric, Ltd. (195,006).—Private company. Registered January 10th. Capital, £1,000 in £1 shares. To carry on the business of electrical and mechanical engineers, &c. The first directors are:—N. Tarshis, 75, Graham Road, Dalston, E.8, engineer; T. Kelly, 13 and 14, Broadway, Deptford, S.E., engineer. Qualification, 50 shares. Registered office: 17, Norton Folgate, E.1.

Brandes, Ltd. (195,038).—Private company. Registered January 11th. Capital, £20,000 in £1 shares. To carry on the business of manufacturers of and dealers in wireless electrical apparatus, &c. The first directors are:—F. Districh, 237, Lafayette Street, New York, U.S.A.; M. C. Rypinski, 237, Lafayette Street, New York, U.S.A.; W. A. Bartlett (managing director), Holly House, Goudhurst, Kent; F. J. Davis, Holly House, Goudhurst, Kent. The two first named are permanent. Qualification, £50 shares. Secretary: Hilda L. Harnor. Registered office: 296, Regent Street, W.1.

Langholm Gas and Electricity Supply Co., Ltd. (12,969).—Registered in Edinburgh January 11th. Capital, £5,000 in £1 shares. To carry on business as indicated by the title. The first directors are:—T. Paisley, Elizabeth Street, Langholm, skinner; R. Paisley, Rosevale Street, Langholm, skinner; E. Harkness, Fernlea, Langholm, secretary; R. D. Ramage, High Street, Langholm, plumber; R. C. Jeffrey, High Street, Langholm, engineer. Minimum cash subscription, £7. Secretary: J. Fairley. Registered office: Gas Entry, Langholm.

Kirkby Stephen Electric Light and Power Co., Ltd. (195,105).—Private company. Registered January 15th. Capital, £1,300 in 110 7 per cent. preference shares of £10 and 100 ordinary shares of £1 each. To adopt an agreement with J. Donald & Co., and to carry on the business of electrical engineers and contractors, suppliers of electricity, &c. The subscribers (each with 10 preference shares) are:—T. H. Gibson, M.D., Redenol House, Kirkby Stephen; J. Cleasby, Hartley Fold, Kirkby Stephen, farmer. The first directors are to be appointed by the subscribers. Qualification, £50 shares. Solicitors: Richardson, Sowerby, Holden & Co., 5, John Street, Bedford Row, W.C.1.

Weston Engineering and Disposals, Ltd. (194,968).—Private company. Registered January 8th. Capital, £1,000 in £1 shares. To take over (1) the business of an electrical engineer, plumber and contractor carried on by Nellie Turner at 2a, Alexandra Road, Moss Side, Manchester, as the Western Electrical Engineering Co.; and (2) the business of an engineering merchant and consulting engineer carried on by A. Heron at the same address. The first directors are:—E. Turner, 29, Morley Avenue, Fallowfield, Manchester, engineer; A. Heron, 133, Oxford Street, Old Trafford, Manchester, engineer. Qualification, £100. Secretary: A. Heron. Registered office: 2a, Alexandra Road, Moss Side, Manchester.

Hamilton Wells Electro Medical Institute, Ltd. (195,005).—Private company. Registered January 10th. Capital, £3,250 in £1 shares. To take over the business of the "Hamilton Wells Electro Medical Institute," carried on by S. A. Westrop, B.Sc., at 67, Church Road, Richmond, Surrey; 248, Corporation Street, Birmingham; 333, Oxford Street, Manchester; 16, New Street, Leicester; 29, Church Street, Sheffield; and 75, Park Street, Bristol. The subscribers (each with one share) are:—Mrs. E. M. Westrop, Claerwen, Stubbs Road, Wolverhampton; S. A. Westrop, Claerwen, Stubbs Road, Wolverhampton, electrical engineer. The first directors are: S. A. Westrop, B.Sc. (permanent managing director and chairman, with £400 per annum as remuneration for his services as managing director) and H. D. Brown (with £30 per annum in respect of directors' fees). Qualification of S. A. Westrop, 500 shares; of other directors, 100 shares. Registered office: Walmer Buildings, 248, Corporation Street, Birmingham.

Marelli Magnetos (England), Ltd. (195,017).—Private company. Registered January 10th. Capital, £2,000 in £1 shares. To carry on the business of importers, manufacturers and exporters of and dealers in magnetos for motor cars, motor cycles, commercial motor vehicles, and other purposes, motors, motor vehicles and accessories and also in all kinds of electrical machinery and parts, including wireless, telegraphic, and telephonic apparatus, &c. The subscribers (each with one share) are:—A. M. Baroni, 19-20, Garlick Hill, E.C.4, electrical engineer; H. T. Louch, 63-4, New Broad Street, E.C.2, C.A. The first directors are: A. S. Benni, B. A. Quintavelle and A. M. Baroni. Solicitors: J. D. Cockburn, 10, New Broad Street, E.C.2.

Official Returns of Electrical Companies.

North Wales Power Co., Ltd.—Mortgage dated December 20th, 1923, to secure £200, charged on certain land near Llandudno Junction. Holder: Miss E. Williams, Inglewood, Tyny Groes, Carnarvon.

East Anglian Electricity, Ltd.—Debenture dated December 28th, 1923, to secure £1,000, charged on the company's undertaking and property, present and future. Holders: L. H. Vulliamy and G. B. Steward, Ipswich.

Campbell and Isherwood, Ltd.—Equitable mortgage on certain lands and premises in Bootle, dated January 3rd, 1924, to secure all moneys due or to become due from the company to Bank of Liverpool and Martins, Ltd.

Radio Improvements, Ltd.—Debenture dated December 19th, 1923, to secure £100, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Miss E. J. W. Senier, 17, Farrer Road, Hornsey, N.

Andcole and Turner, Ltd.—Issue on January 5th, 1924, of £2,000 debentures, part of a series already registered.

Orlings Telegraph Instruments Syndicate, Ltd.—Issue on January 9th, 1924, of £150 debentures, part of a series already registered.

Phillips Valves, Ltd.—Particulars filed of £800 debentures authorised October 24th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Archibald J. Wright, Ltd.—Satisfaction in full on December 5th of debenture dated March 1st, 1923, securing £500.

Consolidated Electrical Co., Ltd. (77,054).—Return dated August 28th, 1923. Capital, £125,000 in 15,000 preference and 110,000 ordinary shares of £1 each. All shares taken up. £1 per share called up on 15,000 preference and 757 ordinary and 5s. per share on 109,243 ordinary shares. £43,067 15s. paid. £81,932 5s. considered as paid, being 15s. per share on 109,243 shares. Mortgages and charges, nil.

Church Stretton Electric Supply Co., Ltd. (80,857).—Return dated October 25th, 1923. Capital, £10,000 in £1 shares. 8,154 shares taken up. £154 paid. £8,000 considered as paid. Mortgages and charges at date of returns, £6,400. Since registered. Further charge dated November 21st, 1923, to secure £1,800.

W. R. Sykes Interlocking Signal Co., Ltd. (93,078).—Return dated October 31st, 1923. Capital, £50,000 in 87,500 "A" and 12,500 "B" shares of 10s. each, 42,297 "A" and 12,500 "B" shares taken up. 3s. 9d. per share called up on 42,297 "A" shares. £7,936 18s. 9d. paid, including £6 5s. paid in advance of calls. £16,824 5s. considered as paid, being 10s. per share on 12,500 "B" and 5s. per share on 42,297 "A" shares. Mortgages and charges, £14,721.

Walsall Electrical Co., Ltd. (37,696).—Return date October 18th, 1923. Capital, £20,620 in £1 shares. 12,000 shares taken up. £10,000 paid. £2,000 considered as paid. Mortgages and charges, nil.

Barsi Light Railway Co., Ltd. (44,589).—Return date October 7th, 1923. Capital, £300,000 in £10 shares. 26,000 shares taken up. £260,000 paid. Mortgages and charges, £140,000 4 per cent. debenture stock and £11,600 "latur extension" debentures.

Simplex Conduits, Ltd. (88,290).—Return dated January 3rd, 1924. Capital, £100,000 in 50,000 ordinary shares of £1 each and 10,000 preference shares of £5 each. 40,000 ordinary and 10,000 preference shares taken. £50,000 paid on the preference. £40,000 considered as paid on the ordinary shares. Mortgages and charges, nil.

W. Sanders & Co. (1915), Ltd. (142,057).—Return dated December 31st, 1922 (filed September 18th, 1923). Capital, £2,000 in £1 shares. 1,005 shares taken up. £5 paid. £1,000 considered as paid. Mortgages and charges, £1,000.

John Spencer, Ltd. (56,764).—Return dated January 1st, 1924. Capital, £75,000 in 10,000 preference and 5,000 ordinary shares of £10 each. 10,000 preference and 1,027 ordinary shares taken up. £55,135 paid. Mortgages and charges, £25,000.

Electricity House, Ltd.—D. E. Campbell, of 79, Lichfield Street, Wolverhampton, ceased to act as receiver on January 10th, 1924.

City Notes.

United River Plate Telephone Co., Ltd.

As briefly mentioned in our "City Notes" last week, an extraordinary general meeting was held on January 15th to consider a resolution giving the directors power to issue 100,000 new £5 shares, thereby increasing the capital of the company to £3,500,000. Sir Frederick Green, K.B.E. (chairman), who presided, explained that the increase was rendered necessary by the great and growing demand for telephone service in Buenos Aires and other large cities in Argentina. The similar addition to capital made last year had been absorbed by the provision of plant necessary to give service to 18,500 new subscribers. The waiting list at the end of last year numbered between 9,000 and 10,000. It was proposed to issue the new shares at par to the ordinary shareholders in the proportion of one to every five old shares held. The new shares would participate in the interim dividend for the current year as if they had been fully paid on January 1st, although they would not be finally paid up until May.

The resolution was carried unanimously.

Allen West and Co., Ltd.

Mr. Allen West, in the course of a speech delivered at the annual meeting of the company, said that the year had been difficult for all industrial companies. Their own prosperity largely depended in the past on the buying capacity of steel works, collieries, and crane makers. Most of their large steel works' customers had been either shut down or working short time, and were not in the market for their manufactures, while British crane makers were short of work and collieries were running at a loss largely as a result of Government control. This company was also faced with very heavy depreciation in values of raw material, of which they had to carry large stocks, which had to be written down during last year. While they anticipated an early revival of the colliery demand, they could see little prospect of a quick revival in the steel and engineering trades. One course open to them was drastically to cut down the staff and organisation of the company; another was to seek new markets abroad and also to utilise the existing plant and organisation in the manufacture of other control gear with a wider market than steelworks and crane control gear. They decided both to seek new markets abroad and to enlarge the scope of their manufactures to the requirements of those markets. In order to develop this policy, they took over the control of the Société d'Usinage de Material Electrique, in which they had previously a small interest to deal with the French market. That company had a freehold works near Paris and staff under the able management of Mr. Heaton, who, in two years, had successfully tackled the problem of marketing their products in France. They also took a controlling interest in Allen West (S.A.), Ltd., a company formed to deal with the South African market. The investment in the French company had been especially beneficial, since the bulk of the orders received from France had been for steelworks control gear, which were particularly welcome owing to lack of sufficient orders for this material in the home market. They had invested just under £30,000 in subsidiary companies, and these investments produced during the year ending July, 1923, over £12,000 worth of orders. Almost the whole of the investment was financed by the dispatch of stock largely rendered surplus by depression in the home market, which was disposed of by these companies in markets which the company could not otherwise have dealt with. All the subsidiary companies were now self-supporting, and during the period under review dividends were received from them equal to over 12½ per cent. on the investment. With regard to the new lines of manufacture, their sales during the period amounted to over 20 per cent. of the total sales of the company, and the orders had since been increasing steadily. The total orders now in hand were 75 per cent. higher than

at the date of the accounts. The improvement showed every sign of being steadily maintained, largely as the result of the increased export business done by the company. The issued capital remained the same, namely, 144,000 ordinary shares of £1 each. The item, "sundry creditors," was a normal amount. £4,936 had been appropriated for depreciation during the period. On the asset side the main alteration was a reduction of £25,000 in stock, due partly to reduced stock and partly to reduced values.

The adoption of the report was seconded by Mr. W. J. Moggridge, and a resolution declaring a dividend of 3 per cent. per annum, carrying the balance of £35,090 forward, was proposed from the chair, and seconded by Mr. O. F. Best. Mr. Victor Breeze was re-elected a director.

Chatham and District Light Railways Co.—The result of working for the year ended December, 1923, was:—Revenue, £81,510; expenses, £57,425; leaving £24,085. Rent of Rochester Corporation lines absorbs £3,744, Income Tax £1,058, Interest Account £2,113, and there is transferred to reserve for depreciation £5,000; leaving £12,170, plus £1,325 brought forward. After meeting the preference dividend of 5 per cent., and paying 5½ per cent. for the year on the ordinary shares, £1,656 is carried forward. There was a decrease of £4,611 in the revenue and £4,407 in the expenses as compared with the revenue and expenses for the year 1922.

Electrolytic Zinc of Australasia, Ltd.—Dividend at the rate of 9 per cent. per annum for the six months ended December 31st on the issue (made in 1920) of 1,100,000 eight per cent. participating preference shares; on the amounts paid up from the respective dates of payment on the eight per cent. participating preference shares allotted (under option certificates rights) prior to December 31st, 1923; and on the ordinary shares. (This does not apply to deferred ordinary shares which do not participate in dividends before July 31st, 1925.) The dividend is payable on March 5th next.

Dublin United Tramways Co., Ltd.—Preference dividend at the rate of 6 per cent. per annum, less tax; final dividend at the rate of 7 per cent. per annum, less tax, on the ordinary, making 5½ per cent. for the year. £60,000 to track renewal; £7,000 to renewal of cars; carried forward £14,490.

Vulcanite, Ltd.—The report for the year ended October, 1923, shows a net profit of £1,356, plus £1,218 brought forward. After meeting the preference dividend, less tax, £708 is to be carried forward.

Aron Meter Co.'s Claim.—According to the financial Press, Aron Electricity Meter, Ltd., have received from the British Clearing Office for Enemy Debts £205,928 on account of their claim against the German Government.

Stock Exchange Notices.—Application has been made to the Committee to allow the following to be officially quoted:—

American Telephone and Telegraph Co.—4,348,600 dol. capital stock.
County of Southland Electric Power Board.—Scrip, fully paid, for £750,000 5 per cent. debentures to bearer of £100 each (guaranteed by New Zealand Government).

Dealings in the following have been specially allowed by the Committee under Rule 159:—

American Telephone and Telegraph Co.—4,348,600 dols. capital stock.

Edgar Allen & Co., Ltd.—Dividend of 6d. per share free of tax.

Shanghai Electric Construction Co., Ltd.—Second interim dividend of 6 per cent. actual, less tax, for 1923.

Greenwood & Batley, Ltd.—Interim dividend of 2½ per cent.

Brazilian Traction, Light & Power Co.—Quarterly dividend of 1 per cent. on the ordinary capital stock.

Stocks and Shares.

MONDAY EVENING.

DOMESTIC politics and the railway strike have combined to produce a situation that has, what the schoolboys vulgarly calls, "put the lid" on Stock Exchange business. There is a little trade doing in some of the most active markets, and in certain departments where it is assumed that neither politics nor strike will have any direct effect, a mild amount of trade continues. People are more concerned, however, with the manner in which they can get to the City in the morning, and, having arrived there, with considerations of how they will get home again, for them to take any lively interest in stocks and shares, with the result that interest is reduced to something like a minimum. Prices are standing up against the general situation with noticeable resistance to the forces that make for depression. There are, however, a good many quotations which have come down not a little within the past six or eight weeks, and the falls have affected gilt-edged stocks as much as any other department in the Stock Exchange.

For example, the new 4½ per cent. debenture stocks, redeemable 1942-72, of the City & South London and London Electric Railways that were issued at 95½ can now be obtained at 3½ or 3¾ discount on the issue prices. Moreover, these securities can be obtained in scrip form, thus enabling the buyer to escape the heavy 1 per cent. stamp duty on transfers. The yield at the present time on both stocks is 4¾ per cent. on the money, and they are both guaranteed as to principle and interest by His Majesty's Government, the security therefore being equal to that of British Government stocks that stand several points higher. They are, of course, trustee securities, and full interest payments are due next July.

Small amounts of Metropolitan-District 6 per cent. debenture and 4 per cent. 1903-5 debenture stocks can be obtained at 115 and at 76½ respectively, the yield in both cases being 5¼ per cent. on the money. These are not trustee stocks, but the security is first-rate, and interest is payable in January and July. Both prices carry the half-year's interest due this month. There is also £5,000 District 4 per cent. guaranteed stock available at 76, with dividends in February and August, the yield in this case being £5 7s. per cent. on the money. London Electric 4 per cent. debenture, in which trustees can invest, is priced at 78, giving 5¼ per cent., and Metropolitan 5 per cent. Preference, also trustee stock, can be picked up to a small extent at 96, which gives £5 6s. 6d. per cent. on the money to a buyer, who will receive his dividends in February and August.

Home Railway ordinary stocks have come down a little during the past few business days, but the failure of negotiations to avert a strike had surprisingly little influence over the market, except in the way of restraining purchases. It has produced no particular amount of selling, holders of the stocks evidently being prepared to see the thing through. So far as the Undergrounds are concerned, the strike had a beneficial effect in diverting more traffic to the lines, though the question on everybody's lips is how long is it likely to be before the Underground motormen throw in their lot with the engine-drivers who have declared war upon the community. Central London ordinary shed three points to 70, and Districts, after being 53½, lost a point. London Electric ordinary went back to 6.

No improvement has occurred in cable stocks, prices, in fact, being lower on the week. Eastern ordinary can be obtained at 157 or thereabouts, which is as low as it has been for several years past. Westerns, Globes and Eastern Extensions stand, roughly, at the same level, and the return at the present prices, taking 10 per cent. free-of-tax dividends as the basis of calculation, works out to 6¾ per cent. on the money, equal to 8¼ per cent., taking tax at 4s. 6d. in the £. The cause of this depression is to be found more in general conditions than in any immediate apprehension in regard to wireless. People do not want to buy stock of any sort just at present, and the consequence is that when any sellers come along they find a market reluctant to take stock except in a few cases, and the prices have to be marked down. The further this process goes, the greater is the uneasiness produced in the mind of the ordinary investor who must concern himself, however, with the reflection that the times are more than ever out of joint, and that to press stock for sale in days such as these is simply to add to the prevailing unsettlement, without benefiting the would-be seller to any extent.

Marconis at 1¼ show a loss of 3s. 9d., but Radios are well maintained because of the renewed rise in the value of the dollar. This factor contributes to advances of 8 in Montreal Light and Power, to 167½, and of 5 in General Electric of New York 5 per cent. bonds to 117½. It has led to smaller rises in the issues of Kaministiquia, Shawinigan, American Telephone and Telegraphs, and similar "dollar" stocks.

Brazilian Tractions dropped back to 49, on a reaction in the milreis, but the price rallied promptly as the exchange recovered. British Columbia stocks remain very firm. Mexicans are without appreciable change. The Anglo-Argentine Tramways issues are disposed to weakness. In the home group, London and Suburban Traction 4½ per cent. debenture stock is 5 lower at 62½ on the fears lest the company's preference shares should receive no dividend next month.

Half-a-dozen falls in the list of Electricity Supply shares are reflections of the apprehensions that surround the advent of a Labour Government to power. They include the ordinary shares of the Brompton and Kensington, Chelsea, Charing Cross, County of London, Metropolitan and South London companies. Edmundson's preference have shed 5s. Manufacturing shares are tolerably steady. Small declines occurred in Edisons, Siemens, and India Rubber shares. Amongst new issues, severe depression is shown by the recently-offered Tata Power debentures, the 4½ per cents. dropping to 6 discount, and the 7½ per cents. to nearly 10 discount. The public are averse from buying Indian investments of any kind at the present time.

The iron and steel market is heavy, in sympathy with the prevailing tendency. Rubber shares made a timid attempt to go better, but the effort met with no public backing, and prices are without material alteration on the week.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend. 1921.	Dividend. 1922.	Price Jan. 21, 1923.	Rise or fall.	Yield p.c.
	£					
Brompton Ordinary	1	12	12	1⅝	— 1/16	£6 8 0
Charing Cross Ordinary	5	9	14½	14	— ½	5 3 7
do. do. do. 4½ Pref.	5	4½	4½	4 7/8	—	5 7 5
Chelsea	1	6	10	9/-	—2/-	5 14 3
City of London	1	14	15	2½	—	6 13 4
do. do. 6 % Pref. ...	1	6	6	22/-	—	5 9 1
County of London	1	8	10	1 13/16	— 1/16	5 3 3
do. do. 6 % Pref. ...	1	6	6	22/-	—	5 9 1
Edmundson's Ordinary	3	Nil	7	3½	—	5 9 5
do. 6 % Pref	5	12/-	6	4½	— ½	6 3 0
Kensington Ordinary		10	12	10⅜	—	5 15 8
London Electric	3	4	10	4½	—	6 7 6
do. do. 6 % Pref. ...	5	6	6	6¼	—	5 9 1
Metropolitan	1	7	8½	1⅝	— 1/16	5 4 9
do. 4½ % Pref.	1	4½	4½	17/-	—	5 6 0
Newcastle-on-Tyne Ordinary ...	1	Nil	2½	16/3	—	3 1 6
do. 5 % Pref. ...	1	5	5	15/6	—	6 9 0
do. 7 % Pref. ...	1	7	7	22/6	—	6 4 5
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	22/-	—	5 9 1
Urban Ordinary	1	Nil	—	17/3	—	Nil
do. 6 % Pref. ...	1	9½	5	17/6	—	6 17 2
St. James' and Pall Mall ...	5	12	14½	11⅜	—	6 3 5
South London	1	7	10	1 1/16	— ½	5 10 4
South Metropolitan Pref. ...	1	7	7	24/6	—	5 14 3
Westminster Ordinary	5	10	12	10	—	6 0 0
Whitehall Elec. Invst., 7½ % Pf.	1	7½	7½	19/9	—	7 8 2

HOME RAILS.

Central London Ord. Assented	Stock	4	4	70	—3	5 14 4
Metropolitan	,,	2½	3¼	73	—	4 17 3
do. District	,,	1	3	52½	— ½	5 14 2
Underground Electric Ordinary	10	Nil	Nil	2⅜	—	Nil
do. do. "A" ...	1	Nil	Nil	7/6	—	Nil
do. do. Income	Bonds	4	5	100	—	*6 0 0

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	109½	—	5 15 11
do. Def.	,,	1½	34/6	23½	—	6 9 0
Chile Telephone	5	6	6	5⅜	—	5 2 2
Cuba Sub. Ord.	10	7	7	7½	—	9 13 2
Eastern Extension	10	10	10	15⅜	— ½	6 8 0
Eastern Tel. Ord.	Stock	10	10	157½	—2½	6 7 0
Globe Tel. and T. Ord.	10	10	10	16½	—	6 1 3
do. do. Pref. ...	10	6	6	10⅜	—	5 11 7
Great Northern Tel.	10	24	22	28	—	7 17 2
Indo-European	25	10	7	22½	—	*5 7 8
Marconi	1	25	15	1⅝	— 1/16	7 15 0
Oriental Telephone Ord. ...	1	12	12	1⅝	—	*6 8 0
United R. Plate Tel.	5	8	8	6½	+ ½	*6 3 1
West India and Panama ...	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	15⅜	+ ½	*6 7 0

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams. First Pref.	5	5½	12½	2 1/16	— 1/16	9 7 2
do. do. 2nd Pref.	5	Nil	5½	2 1/16	—	9 15 6
do. do. 5% Deb.	Stock	5	5	74	—1½	6 15 2
British Electric Traction Ord.	,,	4½	5	67	—	7 9 3
do. do. 6% Pref.	,,	6	6	98½	—	6 1 10
Brazil Traction	100	Nil	4	52	—	7 13 10
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	85½	—	5 17 0
do. do. Preferred	,,	5	9d/-	8½	—	*5 13 3
do. do. Deferred	,,	3	12½/-	10⅜	+1½	*6 9 0
do. do. Deb. ...	,,	4½	4½	78½	—	5 8 3
Lond. & Sub. Trac. 5 % Pref.	1	9½	5	6/-	—	16 13 4
London United Tram. Deb. ...	Stock	4	4	55	—1½	7 5 7
Mexico Trams. 5 % Bonds ...	—	Nil	Nil	63½	—1	7 6 0
do. 6 % Bonds ...	—	Nil	Nil	5⅛	—	Nil
Mexican Light Common ...	100	Nil	Nil	18	—	Nil
do. Pref.	100	Nil	Nil	44½	—	Nil
do. 1st Bonds ...	—	Nil	5	59½	—	8 8 0

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	15	20	44/6	—	*4 9 11
British Aluminium Ord. ...	1	10	5	18/9	—	5 6 8
British Insulated Ord.	1	15	15	2⅝	—	6 6 4
Callenders	1	15	15	2⅝	—	6 6 4
do. 6½ Pref.	1	6½	6½	24/3	—	5 7 2
Crompton Ord.	1	10	5	½	—	10 0 0
Edison-Swan	4/-	10	Nil	4/3	—3d.	7 7 6
do. do. 5% Deb.	Stock	5	5	70½	—	7 1 10
Electric Construction	1	10	10	29/6	—	6 15 7
English Electric	1	5	5	17/-	—	5 17 8
do. do. Pref.	1	6	6	1	—	6 0 0
Gen. Elec. Pref.	1	6½	6½	22/-	—	5 18 2
do. Ord.	1	10	5	19/3	—	5 4 0
Henley	1	15	15	2⅝	—	6 6 4
do. 4½ Pref.	5	4½	4½	4½	—	5 1 10
India-Rubber	1	10	—	⅝	— 1/16	*8 0 0
Met.-Vickers Pref.	3	8	8	2 1/16	—	6 11 0
Siemens Ord.	1	10	10	15/9	—6d.	Nil
Telegraph Con.	13	20	20	23	—	*5 4 2

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price Jan. 22.	Fortnight's Inc. or dec.
a Acid, Oxalic ... ... per lb.	5½d.	...
a Ammoniac, Sal ... ... per ton	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	4½d.	...
a Shellac ... ... per cwt.	£15 15s.	...
a Sulphur, Sublimed Flowers ... ,,	£7 15s.	...
a ,, Roll ... ... ,,	£7 15s.	...
a Soda, Chlorate ... ... per lb.	3d.	...
a ,, Crystals ... ... per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4½d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton	£115 to £190	...
b ,, Wire ... ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net	£219	...
Grade II ... ... ,, ,,	£156	...
Grade III... ... ... ,, ,,	£86	...
c Brass (rolled metal 2" to 12" basis) ,, per lb.	9½d.	...
c ,, Tubes (solid drawn) ... ,,	1/0 to 1/0½d.	...
c ,, Wire, basis ... ... ,,	10½d.	...
c Copper Tubes (solid drawn) ... ,,	1/1	½d. dec.
c ,, Bars (best selected) ... per ton	£93	£2 dec.
c ,, Sheet ... ... ,,	£93	£2 dec.
c ,, Rod ... ... ,,	£93	£2 dec.
d ,, (Electrolytic) Bars ... ,,	£87 15s.	5/- inc.
d ,, Sheets ... ,,	£145 10s.	...
d ,, ,, Wire Rods ... ,,	£77 15s.	5/- inc.
d ,, ,, H.C. Wire per lb.	9½d.	½d. inc.
f Ebonite Rod ... ... ,,	3/6	...
f ,, Sheet ... ... ,,	3/-	...
a German Silver Wire ... ... ,,	2/3	...
h Gutta-percha, fine ... ... ,,	3/6	...
h India-rubber, Para fine ... ... ,,	1/0½	...
Iron Pig (Cleveland Warrants) ... per ton	£5 2s. to £5 2s. 6d.	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£25	...
g Lead, English Pig ... ... ,,	£23 10s.	25/- inc.
g Mercury ... ... per bot.	£9 15s. to £9 17s. 6d.	2/6 inc.
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium... ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3	...
p ,, drawn bars and rods ,,	1/2½	...
p ,, rolled strip & sheet ,,	1/2½	...
p ,, wire ... ... ,,	1/3½	...
c Platinum ... ... per oz.	£35	...
d Silicium Bronze Wire ... ... per lb.	1/0½	...
r Steel, Magnet, in bars ... ... ,,	10d.	...
n Tin, Block (English) ... ... per ton	£231 to £231 10s.	£3 inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	2/11	2d. inc.

*For 1 cwt. lots. Special quotations against definite specifications. Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Earthquakes in Japan.—As a result of another earthquake which occurred on the morning of January 15th in the districts around Tokio and Yokohama, further damage was done, with loss of life. Communication was interrupted, the Yokohama tramway service was suspended, and the power station at Kawasaki, 70 miles from Yokohama, was demolished. In a reference to the September disaster, however, *Commerce Reports* announces that rapid progress has been made in the re-establishment of the telegraph service throughout the earthquake area, stocks of wire at Osaka and Shibaura being available for immediate use in repairing the damaged lines. The telephone system, on the contrary, has suffered severely and its complete restoration will require at least three years. In the Fukagawa and Honjo wards, which were completely devastated by fire, the underground cables sustained only a limited amount of damage, so that the restoration of this section will be accomplished in a shorter period than was expected. The telephone exchanges at Koishikawa, Aoyama, Ushigome, and Yotsuya, serving altogether about 20,000 subscribers, have been re-opened since September 29th. These four exchanges were saved from the conflagration, though the Yotsuya office was badly damaged. The authorities expect to open a big exchange in a central section of the city next spring, increasing the number of telephones by about 10,000. This is, however, a makeshift arrangement, the permanent measures for a complete restoration of the communication system having been left for determination after the main city reconstruction programme is settled. The manual systems will be supplanted by an automatic system.

Fatality.—Albert Edward Bullock, employed in a rolling mill at the British Insulated and Helsby Cable Works, Prescot, became entangled, on January 15th, in the machinery and was crushed to death.—*The Times.*

Electrical Apparatus for the Deaf.

By CHARLES M. R. BALBI, A.C.G.I., A.M.I.E.E.

(*Concluded from page* 89.)

Deafness.

Deafness may be due to the following causes:—

A. (1) Perforation of the ear drum.
(2) Disease of the bone link work.
(3) Growth in the ear.
(4) Fluid in the middle ear.

These are classed under the diseases of the *outer* or middle ear.

B. Disease or malformation of the inner ear, such as hairs or nerves missing.

We may therefore conclude that outer or middle ear deafness is due to obstructive or inefficient transmission of sound to the inner ear. While the "inner ear" may be a perfectly healthy organ, sounds cannot reach it.

When the transmission efficiency of the ear is not too far impaired, a very valuable instrument for amplifying sounds to bring them within the region of audibility of a deaf person consists of a simple microphone cell and receiver. A typical example of this is shown in fig. 6.

The amplification that may be expected from such an arrangement is about 30, which is usually as great as is required by any patient for whom the type of instrument is suitable.

This form of instrument is both simple, effective, and reliable; it is usual to provide some form of resistance so that the patient may moderate the intensity as required.

It is usual for the subject to wear the microphone of the instrument attached to the clothing near the position of the heart. Sufficient attention is not usually

Fig. 6.—The Acoustikon.

attached to the importance of maintaining the relative position of the transmitter; if this is kept constant, the patient is able to get accustomed to the location of sound by a monaural effect in the same way as by the single ear.

The advantage of being able to locate a source of sound with accuracy is too obvious to require comment; It should therefore be understood that by employing headphones with two earpieces operated independently from two transmitters separated by a distance of about 8 in. on the chest, as shown in fig. 7, a far better sense of location may be obtained from a binaural effect, after the patient has gained a little experience, and also by the addition of a further monaural effect to the other ear.

Amplifiers have been tried in conjunction with the type of apparatus just described, but usually they are unsuccessful and are discarded by the patient.

The features that are against them are:—

(1) They are bulky and conspicuous, or altogether unportable.
(2) They require more frequent and expert attention.
(3) They usually err on the side of being too powerful.
(4) They are expensive.
(5) There are acoustic difficulties; specially draped rooms may be required.
(6) There is a tendency for the apparatus to howl.

A Vibration Transmitter.

When deafness is too great to be overcome by the aid of a simple microphonic arrangement, it is essential that some method be attempted to stimulate the organs of the inner ear, other than by attempting to compel a

Fig. 7.—Apparatus for Binaural Hearing.

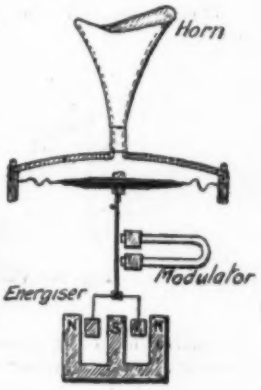


Fig. 8.—Loud Speaker and Modulator.

delicate but deranged system to deal with forces far above its ability. This only tends to increase deafness and to set up irritation.

The way that suggested itself to the author was to stimulate the sensory organs directly by conducting sound vibrations through the bones of the head, avoiding all diseased or ineffectual portions of the outer and middle ear.

The butt of a vibrating tuning fork placed in contact with the head can be heard as well by a person suffering from outer or middle ear deafness as by a perfectly normal person, as would be expected from the foregoing considerations, as it only requires the hairs which may be described as tuned reeds to be stimulated to produce the sensation of sound.

To obtain an instrument that could be modulated in response to speech and other general sounds did not prove to be a very difficult matter.

In the arrangement adopted by the author a permanent magnet attracts a small soft iron armature, which is fixed to the magnet at one end and forms a complete magnetic circuit, except for a small air gap through the core of a pole piece. On the pole piece is a solenoid of copper wire of a few ohms resistance. The whole is encased in an ebonite shell except for a small knob, which is attached to the end of the armature (fig. 9).

When a modulated current is passed through the coil, silent vibrations are produced at the knob of the instrument in response to the nature of the sound waves producing them.

This knob should be placed firmly by the patient on the mastoid bone just at the back of the ear to obtain the best results, but is quite effective when placed on any part of the head.

Any modulated current now received will be trans-

mitted as silent vibrations through the bones of the head to the inner ear, where the sensation of an audible sound will be perfectly reproduced. The instrument is about 3 in. in length and weighs 4 or 5 oz.

The circuit required consists of a small 3-volt dry cell and microphone transmitter, when used as a complete deaf apparatus, or if the instrument is wound to a high resistance, it may be employed in assisting the deaf to hear broadcast radio telephony.

The articulation of such an instrument has a remarkable purity, and is better than any type of headphone yet introduced. The results obtained with a number of very deaf subjects were very successful.

This instrument has one great drawback—it is not possible to pick up general conversation with it, but it is necessary to speak close to the transmitter as in the case of a public telephone unless a powerful amplifier is employed. The explanation for this is that the available energy has to vibrate the whole of the head instead of the very small mass of the auditory system, as in the case of the earphone type of instrument.

When a powerful amplifier is used with this instrument, the necessity to speak into the transmitter is removed, and it can then be made to assist the class of patient who has hitherto been quite unable to listen to a piano that is being played.

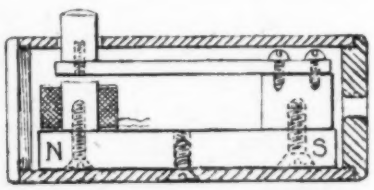


Fig. 9.—Vibration Transmitter.

It was not until a considerable amount of investigation had been carried out that it was discovered that an identical instrument had been patented by Messrs. T. and M. Theiler in the year 1882 under the heading of a telephone receiver. It is, however, believed by the author that it was not recognised by the inventors that it would be of assistance to the deaf, and that it was never used by them for that purpose.

In dealing frequently with the deaf it was recognised by the author that if sufficiently loud sounds could be produced in a room by means of a loud speaker, the less acutely deaf could be made to enjoy the same advantages as the person with normal hearing in respect of such entertainments as the reproduction of music, lectures, and public meetings, provided that the intensity and quality of reproduction were brought up to the necessary standard. In this connection the author has been carrying out some experiments with a loud speaker of his own invention that is designed to deal with large volumes of sound.

A Very Loud Speaker.

A brief description of the apparatus is as follows:—

A strong circular plate about 8 in. in diameter, with a flexible rim, as shown in fig. 8, is kept in constant vibration at a supersonic frequency (50,000 to 100,000 cycles) from some external source of power. The natural frequency of the plate must also lie between these values, and the frequency of the source must be adjusted to the natural frequency of the plate.

Under these circumstances the movement of the plate may be as great as .01 in.

To modulate the plate to give a reproduction of sound, several means may be adopted, such as modulating the power supply or damping the system electrically; however, an easier method that suggests itself is that shown in the illustration, which is a purely friction method, and consists of a soft iron ribbon attached to the centre of the plate at one end and attracting the ribbon to the poles of a "Bell" receiver, a thin piece of ivory preventing the ribbon from actually touching the poles.

In this way a microphone transmitter may be made to vary the friction between the iron ribbon and the ivory surface and thus modulate the vibrations from the plate, and hence a large volume of power may be controlled in a very simple manner. A Rahbek electrostatic effect would be even better, but has not been tried.

In conclusion, it must be stated that patients who suffer from complaints of the inner ear which render them deaf cannot expect relief from any form of electrical apparatus.

The most ready means of testing if a patient's deafness is due to trouble of the inner ear or not is by a range of tuning forks applied to the head. If all can be heard satisfactorily then, however deaf the patient may appear to be, it is possible to restore by one of the electrical means described that great gift with which mankind has been blessed—the sense of hearing.

The Physical Society of London.

ANNUAL EXHIBITION OF INSTRUMENTS.

(*Continued from page* 112.)

Nalder Bros. & Thompson, Ltd.

A large collection of instruments was exhibited by this company. Prominent among these was a rotary synchroscope of the moving-iron type, possessing many advantages. The moving system is extremely light, and the instrument has a very high torque. The low power consumption (from 7 to 10 volt-amperes per side) permits the use of a small potential transformer. The whole of the gear is self-contained for pressures up to 650 V. An important adjunct to this instrument is a light-signalling device which enables the instrument to be read from a considerable distance. Two small lamps are utilised inside the instrument, providing the necessary illumination for the coloured signalling attachment. The design is such that the light can only pass through a small circular hole in an aluminium disk (used also for damping) which moves directly beneath the central portion of the dial of the synchroscope, which is fitted with a number of co-centric sectors of red, green, and white opalescent glass, thus producing a distinct spot of light of changing colour. The position of the light spot indicates the phase angle between the incoming machine and the busbars, a red light being shown when the phase difference is large, a green light when synchronism is almost reached, and a white light when synchronism conditions are attained. In the latest pattern of power-factor meter shown there are no ligaments or moving coils. Complete freedom of rotation is obtained and the meters have a full 260 deg. scale. Owing to the extremely light movement and large working forces the instruments can be relied upon at very low loads. The indications are independent of variations of current, pressure, temperature, frequency, and wave-form. The meters are made in several patterns—for single-phase and polyphase, balanced and unbalanced loads. An example of the Fawssett-Parry triple-pole relay for the protection of feeder cables was also exhibited and demonstrated. This relay, which has already been described in our columns, is now being extensively used in conjunction with the Merz-Price protective system and later developments of this. It is similar in principle to a moving-iron ammeter. It has rectangular stampings, with a rectangular space cut away in the centre, which is bridged by fixed and moving irons in such a way as to leave small air gaps. These irons are surrounded by three concentric coils; one carries the fault current and the other two the current for tripping the switch. The moving iron is attached to a pivoted spindle carrying a switch arm, the whole being controlled by a small spiral spring. When a fault occurs the out-of-balance current causes the moving

member to be repelled from the fixed iron and attracted into a slightly tapering gap until the switch arm closes the tripping circuit through the two outer coils in series. This gives extra torque to make a good contact on the switch arm, and when this contact is closed the outer coil is cut out, leaving in just enough turns to keep the tripping circuit closed. By this means a maximum number of switches can be tripped simultaneously by a given battery. Once the arm of the relay makes contact the process of tripping the main switch must go on until the latter is opened; this breaks the trip circuit, when the relay returns to its normal position and is thus self-setting. Other instruments displayed were reverse-current relays, voltmeters and ammeters of many patterns, wattmeters, "Ohmer" and "Megohmer" insulation testing sets, circuit breakers, frequency meters, &c.

Schall & Son.

This firm exhibited an X-ray spectrometer for the direct determination of the end radiation wave-length of a beam of rays from an X-ray tube. The rays are passed through a crystal and the deflected beam excites a fluorescent screen to the right or left of the central rays, according to the position of the crystal. The central ray is prevented from reaching

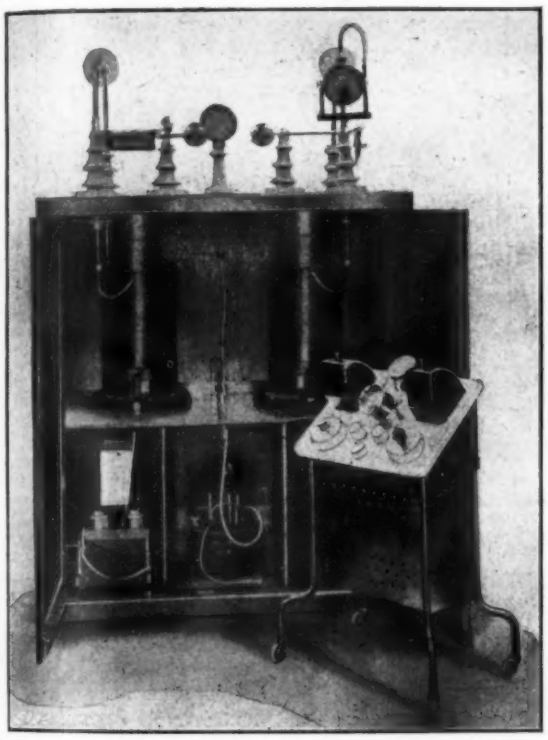


Fig. 10.—230,000-V Deep-therapy Equipment.

the screen by means of a block of lead, and the operator is protected by a sheet of lead glass and by the fact that the instrument is lined with 5 mm. of lead. Another exhibit was a radium balance designed by Dr. Russ and Mr. Clark for the periodic control of tubes of radium. Two ionisation chambers are provided, one being subjected to α radiation from a constant source, and the other to γ radiation from the tube which is being examined. In the former chamber is a gold leaf, which is connected to a large plate in the latter chamber. The linings of the two chambers are connected to the two poles of a 200-V supply, and a leakage takes place in consequence of ionisation. The gold leaf assumes a position of equilibrium in consequence of this leakage, and, provided that the source of radiation is really constant, this position of equilibrium of the leaf can be used for comparing radium tubes.

A complete transformer equipment for generating X-rays was shown, consisting of a high-pressure transformer, auto-transformer, switchboard, tube stand, tube shield, and Coolidge tube, all mounted on a trolley on castors. The principal exhibit was a 230,000 V deep therapy equipment. This set, which is illustrated in fig. 10, consists of two spark coils in series and a mercury jet interrupter. The pressure from the coils is passed through an X-ray tube, the anti-cathode of which is kept at a constant temperature by coiling wire, or through a Coolidge tube of suitable dimensions. The current from the coils passes through two spark gaps to suppress any inverse e.m.f., which might be troublesome at such a high voltage. Moreover, there are in circuit two water resistances, which increase the ohmic resistance of the whole system and so render the generation of h.p. surges less probable. Between the two coils is an electrical relay control, which turns a gas flame on to a palladium tube at the side of the X-ray bulb when the latter becomes too hard, thus keeping the vacuum and secondary current constant. The secondary current varies only within the limit of 0.2 mA. A sphere gap kilovoltmeter is fitted on the cabinet.

Cambridge & Paul Instrument Co., Ltd.

A large collection of apparatus was exhibited by this company. A recording anemometer was shown which embodied an application of the well-known condenser discharge method to the standard Robinson anemometer. The records are taken on a standard thread recorder and a record is obtained every minute or half-minute, and a true mean of the last 15 seconds is obtained on the galvanometer. Two dry cells will work the instrument for months, the record can be taken at a great distance from the anemometer, and the resistance of the connecting cable does not affect the result. The hot-wire micrometer exhibited is an application of a principle similar to that of Dr. Shakespear's hot-wire katharometer. The small movement to be measured or recorded moves the mid-point of a small helical spring in the direction of the axis. The coils on one side are therefore opened out and those on the other side are closed up. The halves of the spring form two arms of a Wheatstone bridge, and the consequent unequal cooling of the two arms throws the bridge out of balance; the bridge galvanometer gives a thousandfold magnified reading of the original movement.

A Duddell-Mather wattmeter was shown. This is designed for pressures up to 75,000 V and is suitable for the measurement of dielectric losses in cables at very low power factors. All the working parts are enclosed by a metallic screen with glass windows, through which readings can be readily taken. This conducting shield is connected to one terminal of the circuit and screens the working parts from electrostatic forces; further, since its external surface is smooth, it serves to obviate brush discharges. The apparatus is mounted on porcelain pillars and enclosed in a glass case.

A new form of electrometer, designed by Prof. F. A. Lindemann, of Oxford, was exhibited. This instrument, which is illustrated in fig. 11, is extremely small, neat, and compact, while at the same time it is robust and easy to use. The moving member is a fine quartz fibre at right angles to a taut quartz fibre which provides the torsional control. The ends of the moving member each move between two opposite pairs of plates, and one end is observed with a microscope, a tiny quartz fibre being fitted across it to act as a pointer. Generally speaking, the mm. movement per volt on the fibre, with from 80 to 100 V between the plates, may be taken as the sensitivity. The period is about one second and the zero is remarkably stable, due to the robustness of the system and the excellent insulation. A string electrometer was also exhibited. Equipment for the automatic control of the temperature of a gas furnace was shown in operation. A thermo-couple, placed in the furnace, was connected to a high-resistance moving coil galvanometer fitted with a calibrated temperature scale. Near the end of the pointer of this instrument was attached a light thermo-couple, which was electrically connected to a moving-coil relay. A small electrically-heated coil was set to the point on the scale at which it was desired to control the temperature. When this temperature was reached the thermo-couple on the pointer was brought opposite to the coil and became suddenly heated; the e.m.f. thus set up energised the moving-coil relay, and so completed an electrical circuit, which in turn energised a ball relay, thereby operating a gas valve. As soon as the temperature fell the thermo-couple left the coil and the process was

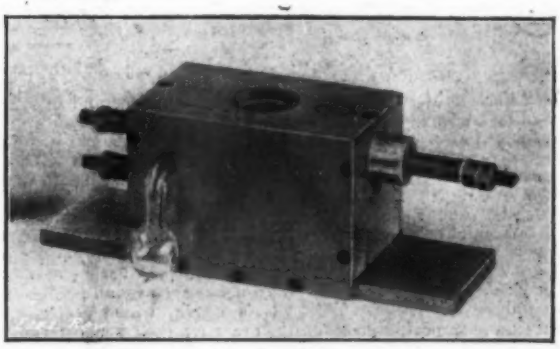


Fig. 11.—Lindemann Electrometer.

reversed. The ball-valve was a glass sphere, into which two platinum electrodes were sealed, resting on a bell-shaped magnet consisting of a hollow steel cylinder, the vertical core of which was wound with a coil. One electrode was covered with mercury and the other electrode was normally above the level of the mercury. On the mercury a hollow steel sphere floated, and when the magnet was energised this sphere was pulled downwards, squeezing out the mercury laterally, and thereby closing the circuit between the electrodes. This operated a simple ball valve in the pipe line.

Other exhibits by the company were a universal testing set, an Eccles valve-maintained tuning fork, a disappearing-filament pyrometer, a valve generator, drum cameras, the "Cambridge" stress recorder, and a vibrograph for recording vibration of roads, bridges, &c.

Elliott Bros. (London), Ltd.

One of the principal exhibits of this firm was a "Multiversal" testing set. This consists primarily of a sensitive pivoted D'Arsonval galvanometer with shunts for varying the sensitivity, together with a number of coils giving resistances of from zero to 110 ohms in 1-ohm steps, coupled up in conjunction with two ratio arms to form a Wheatstone bridge, each ratio arm consisting of four coils—1,000, 100, 10, and 1 ohms. An additional external dial can be provided to extend the range of measurement. A resistance of 100,000 ohms and a three-way switch is also provided for taking the "constant" of the galvanometer and making insulation tests. A key is provided for the insulation portion of the apparatus, and a double successive key that breaks both galvanometer and battery circuits for the bridge part. The set can be used for ten different tests and measurements. A "Multiversal" current transformer which was exhibited is designed to give a large number of ranges with precision in one piece of apparatus. The instrument has five self-contained primary ranges, and by means of a cable wound through a central hole an additional ten ranges may be obtained. The insulation of the transformer is such that it will stand a pressure test of 13,200 V between primary and secondary, and primary and iron, for one minute. The secondary, which is wound for a full-load current of 5 A, is provided with a self-contained, short-circuiting switch to protect the transformer should it be desired to disconnect the secondary burden. A ship's electrical revolution indicator was another exhibit. This is useful in docking and manœuvring ships in harbour. A small magneto generator, driven by a chain from the propeller shaft, transmits impulses to a speed indicator, the dial of which can be illuminated for night working. "Garage" testing sets, flow meters, moving-coil instruments, &c., were also exhibited.

Gambrell Bros., Ltd.

A number of bridges and resistance boxes appeared on this stand, including examples of direct reading instruments. These included series resistances and bridges, and self-contained bridges with a galvanometer and testing cells incorporated in the design. A portable form of Kolrausch bridge was exhibited, suitable for the measurement of the resistance of electrolytes. An induction coil is provided for the production of a.c., and the instrument may also be used for d.c. measurements. The firm operated, in conjunction with Messrs. Evershed & Vignoles, Ltd., a portable c.w. transmitter, by means of which a fixed signal can be sent automatically. The main portion of this was the generator, which was mentioned before in connection with Messrs. Evershed's exhibit. This is a hand-driven machine which, as well as supplying high and low-presssure current for transmission purposes, operates a worm-gear driven contact device of a sector type, which is divided up into the long and short periods in accordance with the Morse message ("S.O.S." or other signal) which it is desired to transmit. A neon tube indicator is embodied in the machine to show if the generator is delivering its current. The set is very suitable for installation in ship's lifeboats.

The Dubilier Condenser Co. (1921), Ltd.

Condensers of many kinds formed the exhibit arranged by this company. Among these were examples of mica condensers for smoothing out the ripple in rectified a.c. ranging from 0.1 to 1.0 mF for pressures of from 5,000 V to 20,000 V d.c. The "Ducon" adapter for enabling the electrical wiring of a house to be employed as an aerial for the reception of radio-telephony was also shown. It is claimed that the device does not affect the lighting in any way, it consumes no current, and is tested at 2,500 V. Other exhibits included "Minicap" switches, one of which is illustrated in fig. 12. These switches are designed for panel mounting in radio receiving sets, and are constructed in such a way that the capacity between the contact is reduced to a minimum. They can thus be used for the switching in and out of valves, high or low frequency, without the introduction of undesirable capacity reaction between the various circuits; as series-parallel switches for aerial tuning condensers, for altering the wavelength range of tuning inductances or reaction coils, and for many other purposes. Substantial tags are provided, to which the connecting wires can be soldered, and the construction of the switch ensures that a good self-cleaning rubbing contact is obtained. A number of anode resistances of from 20,000 to 100,000 ohms was shown.

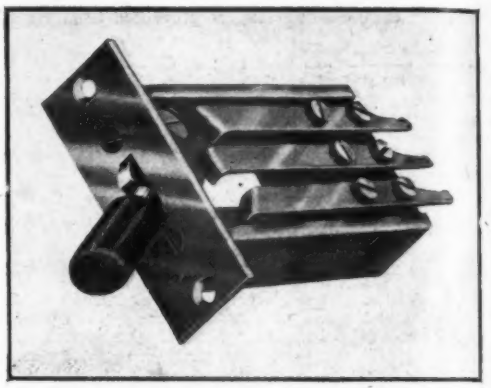


Fig. 12.—A "Minicap" Keyswitch.

(To be continued.)

Electric Passenger Lifts.

By H. MARRYAT, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS.)

THE electric lift was first introduced in America, and in this country we have followed American practice so far as we have been able, but the time has come when we should undertake investigation and research upon our own account, with a view to developing a lift more particularly applicable to our own requirements. The conditions in this country are totally different from those existing in America. We are restricted in our buildings to a capacity of 250,000 cu. ft., whereas in America there is no such restriction. On the other hand we are delightfully free from "red tape" in the design of our lift machinery, whereas in America it has been found necessary to impose restricitions and by-laws which, whilst protecting the interests of the community, are nevertheless a deterrent to the progress of invention and design.

There are a number of problems concerning the construction of electric lifts, the solution of which would be of great benefit to the industry. A fundamental problem is that of definition. It would be useful for lift-makers to get together and adopt a code of definitions.

An electric lift is too complicated to admit of two makers quoting for the same equipment, unless to a very detailed specification such as can only be prepared by a lift engineer, and such important factors as maintenance costs, energy consumption, and attendance are greatly affected by the details of the design offered. The actual service given by lifts built to the same general specification and designed to run at the same speed under the same general conditions will also vary considerably, and the number of trips which will be completed and passengers carried in a day by a lift acting upon a smooth and rapid acceleration curve, with accurate floor levelling, will be far greater than with a lift less carefully designed. It is advisable, therefore, that the architect should, in the earliest stages of the project and before any building plans are settled, call in either a consultant specialising in lift engineering, or a manufacturer of experience.

Lift makers complain that they are not consulted until it is too late to influence the general specification. A really efficient lift service is of far more importance than the staircase. Its location should be a primary consideration, and the staircase considered principally in relation to its effectiveness as a fire escape.

In fig. 1, curve (1) represents the average traffic counted in a group of West End drapery establishments. In each case the number of persons proceeding per hour from the ground floor to any other floor has been counted, and the curve represents the average of all establishments examined. Curve (2) represents a similar average deduced from a count taken in a large group of City office buildings of the class in which the floors are sub-let to a variety of tenants. The curve indicates the number of persons per hour who arrive at or pass the second floor. The third example comprises a similar group of offices situated in the West End of London. In each case the figures have been reduced to per 1,000 sq. ft. of rental floor space served by the lifts. The different characteristics are strikingly shown.

Traffic is inclined to move in bunches, and errors are likely

to arise from taking a count over any period longer than one minute, as it is the maximum traffic and not the average with which the lift engineer has to deal. If provision is made for the average traffic only, people will either wait for several minutes for lift service or use the stairs in preference.

It has been maintained that lifts of a speed of over 250 ft. per min. cannot be justified in this country because of the lesser height of our buildings, as compared with those in America; the periods of acceleration and deceleration occupy practically the whole time of the short average journey, so that there is no opportunity for the lift to run at its full speed. The objection is a sound one and is supported by the practice of making the acceleration and deceleration periods long, in the belief that it is necessary to do so if the internal economy of passengers is not to be upset. Nevertheless, as ground space is of so great a value in large cities the importance of designing a lift which will accelerate and decelerate quickly, and so permit advantage to be taken of higher speeds, will be appreciated.

In order to investigate the effect of various forms of lift acceleration upon the average passenger, I have

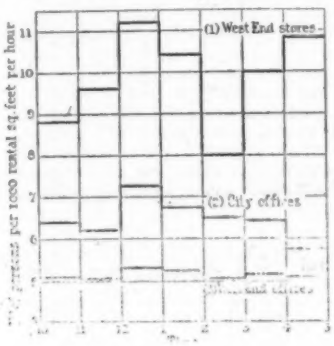


Fig. 1.—Average Traffic Curves.

made a large number of experiments. Films, fig. 2, illustrating the acceleration of a passenger lift running at 300 ft. per minute, obtained with the aid of special apparatus and a method that has not been used before for the purpose, show that the unpleasant sensations experienced by most passengers at the starting and stopping of a fast-running lift are due not so much to a too rapid acceleration as to a sharp change of acceleration, the result of imperfect control. The remedy is not an extension of the total period of acceleration, but a correction and smoothing out of the curve. Working upon these lines it is found possible to accelerate a lift to 300 ft. per minute within a space of 24 in., or 2,600 ft. per minute in less than 48 in., without discomfort to the passengers, and to decelerate in a similar period. This means that the time lost in acceleration and deceleration of a lift at 300 ft. per minute with average runs of 42 ft. need not exceed 5 per cent. of the running time, and at 600 ft. per minute, 10 per cent., the number of seconds lost being the same in each case. It also means a saving in energy consumption.

A time/distance curve that represents a condition of particularly comfortable starting has been chosen to illustrate, fig. 3, the derived velocity and acceleration curves. Fig. 3*a* shows that the lift attains a maximum velocity in 1.4 sec. In fig. 3*b* the acceleration over the first fifth of a second is not plotted because it has not been found possible to obtain accurate measurements from this part of the film. As more information about this part of the acceleration curve is of great importance, I am arranging to investigate in detail what happens in this first fifth of a second.

The acceleration proceeds in a series of periodic leaps. Although the starting contacts undoubtedly affect the shape of the curve they are not responsible for it. For instance, if the number of starting contacts is reduced, the number of periods shown on the acceleration curve is increased.

I am not as yet prepared to explain the cause of this periodic acceleration; perhaps the shape is governed by various forces acting sometimes together and sometimes in opposition, depending upon the conditions of starting. The steps in acceleration, fig. 3*b*, are too rapid to have any physical effect upon the passengers, for the purpose of considering which question an average curve should be drawn. In this sense the curve is a good one, provided that the unplotted part in the first fifth of a second does not descend from too great a height. A 600-ft.-per-minute lift will carry 26 per cent. more passengers per hour than a 300-ft.-per-minute lift will do, or to carry the same number of passengers it may be of 20 per cent. less capacity. With the increasing site values in our cities there is opportunity for the economic use of higher speeds.

The speed of the lifts on the London electric railways is about 180 ft. per minute, except at Hampstead, where the shaft is deeper than that at any other station, *viz.*, 181 ft.; there the speed is 200 ft. per minute. There is a tendency to increase the speed of tube railway lifts to meet the desire of the travelling public for faster travel. A lift service, however well run, compares unfavourably with an escalator service, and lifts have been replaced by escaltors at a number of stations. For all shafts of a depth of 60 ft. and under the escalator provides a better means of transport, but for a shaft above this depth high-speed lifts are desirable.

The cost of maintenance of an electric passenger lift in business premises varies from about £20 to £100 per annum, and is largely affected by the frequency of re-roping—largely made up of labour and often augmented by the necessity for overtime work. A prime consideration in the selection of a lift should, therefore, be the ultimate maintenance cost, and to accept tenders for lifts without this consideration is to place a premium on inefficiency.

Frequently the breaking strain of the ropes to be employed on a new lift is specified without regard to the fact that a rope of less tensile strength, of the super-ductile class, will in many cases give better results over a number of years. If such ropes are to be employed care must be taken in the first instance that the lower breaking strain is compensated for by larger, or additional, ropes, to provide the necessary factor of safety.

My experience suggests the use of a super-ductile steel for ropes which fail on account of damage by bending, and a hard steel of high tensile strength for lifts on which the ropes fail from the frictional wear due to slip between the ropes and the driving sheave. A most important factor affecting the life of ropes is the method of reeving employed. The option to select the best method is often taken out of the hands of the lift maker by the architect, who advances his plans too far before the details of the lifts are considered.

Fig. 4 shows the methods of reeving more usually employed, in (*a*), (*b*), (*c*) and (*d*), the winding engine being at the head of the well, and in (*e*), (*f*), (*g*) and (*h*) at the foot. The ideal arrangement is (*a*). Arrangement (*c*) may be employed where the out-of-balance load is considerable and there is danger of rope slip on the driving sheave. It is possible with this method of reeving to employ U instead of the usual V grooves on the driving sheave, thereby greatly reducing the wear on the ropes. Arrangement (*d*) introduces a 2:1 reduction in car speed. This method and further extension of the same principle may be employed when very heavy loads have to be raised at low speed. S or backward bends in the rope should be avoided, as they are much more destructive than a series of bends in the same direction. The arrangement shown in (*f*) is exceptionally destructive of the ropes. The larger the diameter of the sheaves the longer will be the life of the ropes.

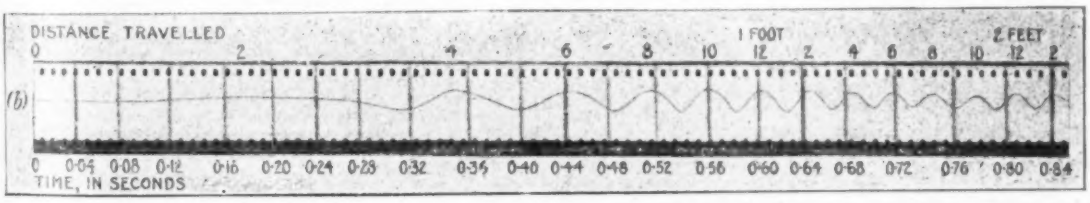


Fig. 2.—Acceleration Film.

The advantages claimed for placing the gear at the foot of the well are in practice largely non-existent, whereas the obvious disadvantage of employing ropes of at least treble the length is very evident. The wear is greater and, except in the very unusual event of the winding engine weighing more than the combined weight of the car, load, and counterweight, the strain upon the upper structure is greater if the winding engine is located below.

In arrangements of winding motor, worm gear, brake, and sheave, the fundamental difference is whether the worm is located below or above the wheel. The over-worm type I advocate is the more expensive, and, if it has the superiority I claim, deserves due allowance in the consideration of competitive tenders.

The push-button lift is the more expensive, but the difference in cost is far more than justified by the saving in the cost of attendance. Its capacity is, however, far less than that of a car-switch lift of the same size, because there is some difficulty in employing a higher speed than 150 or 200 ft. per minute with an automatic lift, and a single passenger obtains complete control over the lift until he has completed his journey, although there may be many passengers waiting at intermediate floors. The automatic lift is, therefore, only

suitable where the traffic is never so dense as to require the full capacity of the lift for many minutes at a time. Its scope might be considerably extended by the introduction of a satisfactory self-closing gate and floor-levelling device, which would permit of a higher running speed being employed.

A very useful form of control that is not sufficiently employed consists of a combination of the push-button and car switch with a change-over device, so that during busy periods the lift may be car-switch operated at high speed by an attendant, and during slack periods push-button operated at a lower speed by the passengers.

The most promising line for further advancement would seem to be in the direction of deceleration control, especially in conjunction with automatic lifts, thus permitting higher running speeds to be employed. The energy consumption is principally dependent upon the number of times the lift is set in motion, and with a car-switch lift it depends very largely upon the skill of the operator in stopping the lift at floor level. The higher the running speed of the lift the more likely is this loss to occur, owing to the increased difficulty of gauging floor level, but the fact that various makers recommend various solutions is in itself indicative that finality is not reached.

Messrs. Waygood-Otis have introduced a "Micro-drive," which not only attains the end in view, but also maintains

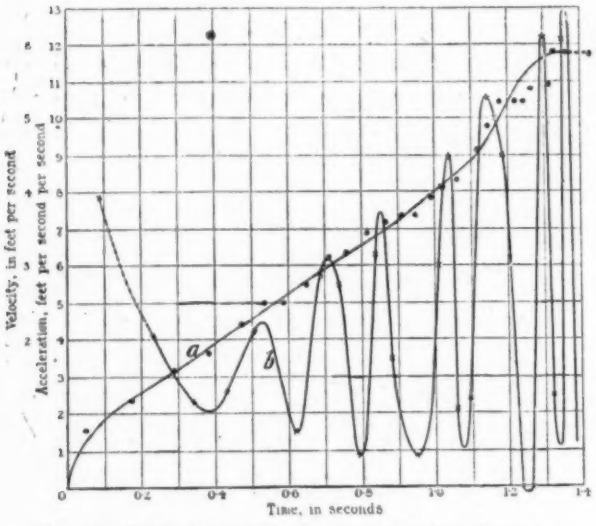


Fig. 3.—Derived Acceleration and Velocity Curves.

the car at the exact floor level irrespective of the stretching of ropes or any other circumstance; that is to say, the lift having stopped at a particular floor, a heavy load wheeled into it may cause the car to sink—say half an inch—then the micro-drive machine will at once raise the car that half-inch.

There are no doubt many special applications for such an arrangement, but for the purpose we have in mind at the moment it is questionable if the expense, as compared with that of other methods, is justified. There would also seem to be some danger, if the micro-drive can move the car whilst the gates are open, of a passenger being caught by the toe or in some other way between the slowly moving car and a fixed part of the well.

A device to attain the same end—evolved by Mr. Murray D. Scott—is inexpensive and has the advantage that the motor and controller employed are normal and that a certain amount of the energy utilised may be returned to the line.

A development of this idea, with special relation to automatic lifts, permits of comparatively high running speeds being employed with the surety of accurate floor levelling under all conditions of load. The design, which is termed the "Auto-Pilot," has only recently been protected, and is in the experimental stage. Two knobs in the car are marked "up" and "down." On one of these being depressed the lift accelerates and runs at normal speed. As the car passes each floor a signal light glows, and if the knob be released during the period of illumination the car will decelerate and stop level with the next floor.

The percentage of accidents is extremely small and apparently rapidly decreasing. My experience is that the majority of accidents have resulted from one or other of the following conditions: (1) Absence of gate and interlock contacts on the car; (2) failure of gate-locks; (3) insufficient enclosure. A most valuable contribution to safety is to be found in efficient lighting.

It is very difficult to persuade architects, builders, or property owners of the necessity of carrying the enclosure above 6 ft. 6 in. in height in stair wells and other open places. A lift enclosure should be what its name implies and not, as many architects seem to think, a means of expressing their architectural ambition in iron and bronze. An enclosure which will allow an arm or leg to be thrust between the bars or below the bottom rail is dangerous. The triangular space above each stair tread is a particularly dangerous point and should always be filled in. Upon the counterweight side, at least, the enclosure should extend from the floor to the ceiling. I have found it reasonable to insist upon an inspection after every 6,000 journeys, with a maximum interval of three months between inspections.

Discussion in London.

Mr. G. BAKER (London Underground Railways) opened the discussion by agreeing with the author as to the bad placing of lifts by architects, which often caused the maintenance cost to increase greatly. With regard to lift speeds and acceleration curves, he asked whether the variations indicated might not be due to changes of the motor torque and irregularities in the tooth gear? Nearly all their lift ropes had S bends, and they paid for it—steadily. Placing the worm below the wheel was the better arrangement from the point of view of lubrication. Gearless lifts were thought highly of from maintenance considerations; they were practically two-bearing machines having only two renewable parts. They were more costly, but very attractive, especially if not restricted to the low-speed type. He favoured clapper type of control gear.

Mr. L. MOLD referred to some of the serious difficulties that lift makers had to face. He thought more lifts should be installed in London buildings, and pointed out that many of those that existed were inadequate for the work they were called upon to do. The author had rightly emphasised the importance of acceleration and deceleration, but all his examples were of d.c. lifts. He (the speaker) would like to hear something about a.c. equipment, particularly with regard

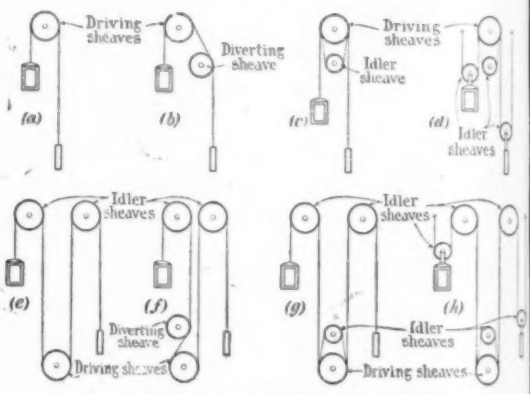


Fig. 4.—Methods of Reeving.

to deceleration. Reliable, smooth, and rapid acceleration could be obtained if the control apparatus was properly designed. They had abandoned sliding controllers, and now supplied only those of the butt type.

Mr. B. A. SIDEN (H.M. Office of Works, Engineering Division) agreed in the main with all the points made in the paper and also with the author's method of estimating lift capacity. Specialists were too seldom consulted. He hoped to see the whole matter governed by regulations; until then users would only consider cost, and allow the lift to run on until it broke down. Many so-called minor things had to be considered, and plant that seemed to first sight desirable might be very expensive to maintain. There was some difficulty in getting skilled men to properly maintain sliding contact controllers, otherwise he preferred that type; the current density was often too high, which led to the flexible connections of clapper switches being damaged by over-heating. Of the gearing, the worm was the portion subjected to the most wear; he therefore preferred the over-driven type, as it was more easily noticed. He was glad the a.c. question had been raised as there would soon be a demand for a.c. lifts; the polyphase type was fairly alright, but the single-phase pattern needed developing. Unless high-speed lifts were limited to serving the higher floors, there was little advantage in using them. Possibly a low-speed lift could be provided for the lower floors and high-speed one for the higher, otherwise a moderate speed would be better.

Mr. B. P. WALKER explained that if the acceleration was properly designed to be even, no matter how fast, lift passengers would experience no sinking feeling. He referred to the micro-drive, and pointed out that it was a simple matter to apply it to a.c. equipment.

Mr. P. GOOD said that the B.E.S.A. was preparing a comprehensive list of terms, as suggested by the author. Rather too much importance had been attached to floor-to-floor traffic because many people walked downstairs. Automatic lifts which would return to the ground floor should be seen more and there was great need for means of testing safety devices which were seldom called upon to function, but must always be ready to operate.

Mr. W. R. RAWLINGS pointed out that the author had omitted from his paper any reference to the cost of energy in £ s. d. The speaker quoted several cases to show that

cost of operation and energy was very small; in one instance the cost of electricity was only 1s. 6d. per week, although the lift was open to public use. Electricity supply authorities were not anxious to supply lifts because the revenue was so small; electricity was very much cheaper than hydraulic power.

Mr. H. MARRYAT, in the course of his reply, said that a two-speed motor was necessary for a high-speed lift in order to enable it to slow up before stopping. He appreciated the advantages of clapper control gear, but it was noisy and had other drawbacks; the sliding contact pattern of gear could hold its own in competition.

Discussion at Manchester.

Mr. H. Marryat read his paper before the members of the North-Western Centre on January 8th. In the absence, through indisposition, of the chairman of the Centre (Mr. G. A. Juhlin), Mr. H. C. Lamb presided.

The discussion was opened by Mr. H. C. CREWS, who said that in 1915 a useful paper was written by Mr. Inglis, a student of the Manchester Centre, but apart from that, during the last 25 years the only paper dealing with electric lifts that had been placed before the Institution was one read by himself in April, 1906.

He would agree with the statement "where electricity is available it has practically superseded all other forms of energy for new construction" if he was allowed to add the qualification "if the price of energy allows electricity to be a commercial proposition." Leading architects realised that the questions involved in lift construction were too technical for them to deal with, but there were thousands of other architects who wanted the lift makers to conform to the specifications they had drawn up. The acceleration and deceleration films conveyed valuable information, and nothing of the sort had been attempted before. Sheave drives were used mainly because they were cheaper, handier in a way, and to some extent more efficient; on the other hand, the drum-drive had many advantages and, particularly for heavy weights, he had found it very useful. He had never had to renew drum-driven ropes, which should certainly last from 10 to 20 years, whereas the sheave-driven rope had an average life of five years. In the paper it was stated that "the cost of maintenance of an electric passenger lift in business premises varies from about £20 to £100 per annum." Those figures were too high. He had seen so many good safety gears that he was sure in the future they need not confine themselves to self-sustaining conditions by the use of low-efficiency worm-gear. The combination of press-button and car-switch control was most desirable. He had adopted it and users were very pleased with it. If it was done at the outset it did not cost very much more to adopt both, and in many cases it was a great advantage. A great deal could be done in the way of returning current to the line during deceleration, but, unfortunately, the electricity supply authorities had a knack of installing a non-reversible meter.

In his experience failure of cage lock was the principal cause of accidents; he only knew of two cage locks that he considered safe. He agreed about the necessity for efficient lighting. In many cases the electricity was sold at the power rate and the cost was reasonable. Few people realised how economical the electric lift was. Averages of half a dozen lifts of the ordinary sort, running from 150 to 200 ft. per minute, carrying from 7 to 15 cwt., from 40 to 60 ft. travel, did not show a consumption cost in any case exceeding £10 per annum. A very busy office block in Manchester averaged 1,099 kWh per annum over two years; a Manchester cotton warehouse employing a lift for moving goods had an average of 355 kWh over three years; another warehouse averaged 563 kWh over three years; a block of offices averaged 666 kWh over six years; a hospital with a bed lift, which was used a good deal for patients, averaged 404 kWh over six years; an office block in London averaged 614 kWh over two years. If power could be got at 2d. per kWh the cost would be very low; even at 3½d. it did not amount to anything serious.

Mr. RAEBURN suggested that the designers of electric lifts would obtain much valuable information from a study of electric winders, which ran up to a speed of 4,000 ft. per minute, and other types of hoists used in steel works and blast furnaces. The latter ran up to 600 ft. per minute and had all sorts of automatic gadgets which had been developed quite independently of the electric lift.

Mr. MALLINSON said that the wearing of the rope was due to bending in the reverse direction almost immediately. Even if the bending was very slight the fibres of the rope seemed to be affected very materially. A similar reason accounted for the short life of some steel ropes. Accelerating up to 300 ft. per minute in a distance of 24 in. meant a high peak load relatively to the motor h.p., and probably would affect the Corporation's desire to give cheap power. He had had heart-breaking experiences with lift controllers which, on paper, were perfect, with everything to safeguard them, but in practice were always breaking down.

Mr. SILLS remarked that surely a lift could be made to some B.E.S.A. standard, to carry as many people as could get into it.

Mr. DIBBEN suggested that the peaks in the acceleration curve might be due to the elasticity of the rope.

Mr. PECK thought it was partly due to the elasticity of the rope. In the drilling of well holes with a heavy drill on the end of a long steel rope the action was just as though one had a weight on the end of a rubber band and it was necessary to synchronise the engine very carefully with the elasticity of the rope. Possibly there was some jerking, due to the stopping of the controller, which caused the stretching of the rope.

Mr. HERBERT said that lifts should certainly be made fool proof. With alternating-current lifts it was very convenient to have a direct-current supply to operate the controls, and in very many cases it would be almost worth while to put in a battery of accumulators or a small motor generator for that purpose.

The CHAIRMAN said that Mr. Crews's idea appeared to be a very low price with a reversible meter, so that the return to the supply authority would be practically nil. He believed there were now on the Manchester electricity mains over a thousand lifts.

Mr. H. MARRYAT, in reply, said that for lifts of considerable power drum-driving became almost impossible, for one thing, because of the size of the drum. There were some very bad cases in London; one lift was maintained at a premium of £100 per annum and the actual cost sometimes exceeded that sum. It was a very busy lift and was re-roped twice a year. American practice was to use a high-efficiency worm gear, but the whole energy cost was a small item compared with other matters—interest on capital, depreciation, attendant's wages—and it was not worth while to increase efficiency from 50 to 90 per cent. Besides, a worm gear with high efficiency entailed the further obligation of additional safety devices. It was usual to attach a very powerful brake on the low-speed shaft in addition to the usual brake on the high-speed shaft.

It was a good lift controller that would work for, say, 15 years; however, things had advanced so much that one must not judge electrical controllers by lift performances. A controller which did 60,000 journeys was not an unreliable piece of apparatus.

He agreed that the peaks in the acceleration curve had some connection with the elasticity of the rope, although he thought other things also had some influence. There were several self-closing gates in America, but he did not think there was anything on the market yet which was safe, reliable, and not too expensive to install.

Economic Conditions in Australia.

Developments and Prospects.

A REPORT on economic conditions in Australia up to June, 1923, by Mr. S. W. B. McGregor, H.M. Senior Trade Commissioner in the Commonwealth, has recently been issued by the Department of Overseas Trade.*

From complaints received by Mr. McGregor it would seem that there are a number of British firms whose commercial organisation requires overhauling and strengthening, and that there are some, moreover, endeavouring to do business in Australia without adequately appreciating Australian conditions and the outlook of the Australian people. High travelling and other expenses are a troublesome factor. The commission agent, Mr. McGregor says, in many cases requires more sympathetic treatment and greater financial support.

*D.O.T. or the Stationery Office. 2s. 6d.

Iron and Steel. It is common knowledge that iron and steel manufacture in the Commonwealth has not progressed as rapidly as the Australian interests wished. For the year ended December 31st, 1922, it is recorded that the production of finished steel totalled 62,374 tons, as compared with 183,673 tons during the previous twelve months. It will be remembered that the Broken Hill Proprietary works at Newcastle (N.S.W.) were closed down from about May, 1922, to February, 1923. During this period many plant improvements were effected and the works completely reorganised. Rylands Bros. (Australia), Ltd., are now said to be drawing the whole of their rod requirements from the local works, and as soon as sheet bar was available from Broken Hill the sheet plant of John Lysaght (Australia), Ltd., was re-opened. Mr.

McGregor reports the approaching completion of negotiations for the establishment of a plant in Australia for the manufacture of wire ropes, but adds that the Queensland Government's project for establishing a steel works at Bowen appears to have been abandoned.

He adds that Metal Manufacturers, Ltd., have considerably augmented their works at Port Kembla (N.S.W.), which are now capable of handling more than the Commonwealth's requirements of copper wire, rods, bars, strips, cables, &c., copper and brass tubes and pipes, and aluminium steel-cored cable. The company is now making covered telephone cables.

Slow Factory Growth.

On the subject of Australian manufacturing industries generally the Trade Commissioner states that comparatively slow progress is being made although they are protected by a high tariff, in some cases almost a prohibitive tariff. The reasons, in his opinion, are an almost stationary and relatively small home market, which, together with the high costs of production and distribution, render an export trade for manufactured goods of any magnitude practically impossible.. The best gauge of manufacturing expansion, he says, is the number of hands employed; in 1913 this was 337,101, and in 1921-22 no more than 395,425—no great progress in eight or nine years. In all the circumstances it is scarcely surprising that progress in the establishment of branch factories by home concerns has been relatively inappreciable.

The report gives a short description of the scope of the Commercial and Industrial Bureau of the Commonwealth Board of Trade, the Institute of Science of Industry, and the Tariff Board. The last-named consists of three members, representing the Customs Department, Australian manufacturers, and importers' interests. It has wide powers and its decisions are criticised on account of the delay and uncertainty. As a result of its varied industrial investigations it has such an extended knowledge of every class of machinery produced locally that it is able to refer applicants to Australian makers of their requirements. Wherever machinery cannot be obtained in Australia and it is required in the establishment or development of industries, the Board has freely recommended admission under Tariff Item 174.

Future Electrical Demands.

The future demand for electrical machinery, cables, and apparatus, which it will be long before local industry can supply in sufficient quantity, is closely connected with the schemes for the development of water power and of the brown coal deposits of Victoria. As a result of the surveys, the Trade Commissioner says, it is estimated that in New South Wales there is a possibility of developing 320,000 h.p. continuously, of which the Snowy River project accounts for 145,000 h.p. Regarding the Victorian Brown-coal scheme, Mr. McGregor summarises the position as follows:—

Brown Coal Deposits of Victoria.

The developments at Yallourn, where the brown coal open cut, the power house, the briquetting factory, &c., are situated, is proceeding most satisfactorily. Over 400,000 cu. yd. of overburden have been removed from the open-cut area, exposing nearly 10 acres of brown coal. The main power house is nearing completion, and the installation of the generating plant is being rapidly advanced. The briquetting factory is nearly completed, and it is expected that electric current and brown-coal briquettes from Yallbourn will be available at points throughout the State about June, 1924.

The Commission's brick works is turning out 6,000,000 bricks per annum for use in the construction of the township and works. The township to house the Commission's employés is developing rapidly.

The Yarraville (Melbourne) Terminal Station of the high-pressure transmission line, together with its switch and transforming gear, is almost completed, as is also the installation of additional supplementary generating plant at Newport "B" (Melbourne) power house. Under the Commission's scheme of electric supply to country districts the transmission lines to the South-Western and Gippsland districts are practically complete. The undertaking of the North Melbourne Electric Tramways and Lighting Co. is developing rapidly, and all new requests for service are being met.

The development of the hydro-electric resources in the State of Victoria is, in common with the Yallourn project, in the hands of the Electricity Commission. Although, in view of the rapid developments at Morwell, hydro-electric power is not urgent, the preliminary work in connection with this scheme is well in hand. The construction of the main transmission line from Melbourne to Sugarloaf, and thence to Benalla and beyond, is to be accelerated so that this northern country can be temporarily served with electricity from the Yallourn scheme, pending time when the hydro-electric works are completed.

Nearly one-half of the plant for the Yallourn power house was manufactured in Australia, whilst £818,000 has been expended on plant of British manufacture. The moisture contents of the surface coal at Yallourn is from 45 to 50 per cent. by weight, but now that the underground coal has been uncovered, the moisture contents of this coal, which will be used in the power house and for briquetting, has been found to be from 60 to 65 per cent. It is considered that this unexpected additional moisture will not materially affect the cost of current. It appears probable that the estimates of cost of construction and cost of current will be somewhat exceeded.

In an appendix, Mr. Ross, the honorary trade correspondent at Hobart, reports as follows on hydro-electric development in Tasmania:—The power station at Waddamana is capable of generating 63,000 h.p., and when the Shannon Scheme, which is now in the preliminary stage, is completed this will be increased by 13,000 h.p., making a total capacity of 76,000 h.p. The plant at present in operation has a capacity well in excess of current requirements, as it is estimated the maximum load does not exceed 53,000 h.p., and with the completion of the Shannon Scheme the department will be in a position to provide for any extra demand of ordinary dimensions that may arise during the next few years.

The energy sold for the manufacture of zinc and carbide during the twelve months ended June 30th, 1923, amounted to 155,769,623 kWh, being an increase over the preceding year of 135 per cent. For general lighting and power purposes in the cities of Hobart and Launceston the power used during the same period amounted to 17,171,352 kWh, representing an increase over the 1921-22 consumption of 108 per cent. The capital expenditure amounts to £2,825,000. The department has been able to meet all charges and expenses, and carry forward a small profit.

Mr. McGregor includes in his report figures showing the imports of electrical machinery during 1922-23; these were reproduced in our issue of January 11th (p. 56).

Ferguson Pailin Armourclad Switchgear.

New Compound-filled Oil-break HV Type.

MESSRS. FERGUSON, PAILIN, LTD., have recently developed a new line of switchgear on the vertical draw-out principle, of which several 33,000-volt units have been installed at Manchester, and a quantity for 11,000 volts are now being erected at St. Marylebone. They have been designed for large central stations, and are especially suitable for duplicate busbar systems and remote electrical operation. The sizes at present made have a range up to 2,000 amps. at 11,000 volts and 750 amps. at 33,000 volts.

A sectional view of the unit is shown in fig. 1, which indicates a duplicate busbar system and an oil breaker of the vertical draw-out pattern, which is virtually two breakers in the one tank—one for each set of busbars. Normally one switch is "on" and the other "off," and only when used for busbar coupling are both switches "on" together, as shown in the illustration.

Each of the two breakers has its own system of operating levers, and each is provided with its own closing solenoid and shunt trip-coil, so that, normally, the selection of busbars is done from the control board; the switchboard attendant takes full control of busbar selection, and there is fixed responsibility. The changing over is done by simply pressing push buttons, so that much time and labour is saved. Moreover, the double-switch arrangement practically enables one switch to be used as a stand-by for the other, and it can be put in use through the hospital busbar immediately.

Each unit has its own raising and lowering gear for the breaker, which is motor-operated. Despite the fact that the breaker weighs 2¼ tons and the tank (with oil) 1½ tons, it can be lowered to the isolated position in half a minute and the tank lowered within three minutes; therefore, periodical inspection is facilitated. There is no need for the attendant to enter the high-pressure switch room unless he wishes to carry out repairs, all ordinary switching operations being done from the control board. All the units are fully interlocked, and the conductors cannot be exposed until the breaker has been tripped and lowered into the disengaged position.

Other advantages are: (i) Any breaker can be used as a busbar coupler by operating the electrical interlocking switch on the control board and allowing both breakers to close at once; (ii) the vertical arrangement demands less floor space than does a corresponding horizontal draw-out unit; (iii) the connections are generally more direct and a smaller number of joints are employed.

The unit consists of the fixed and draw-out portions, the latter situated below the former and only moving in a vertical direction. The electrical connection between the two is by means of vertical isolating plugs and sockets. The fixed portion consists of two sets of busbar and isolating-plug chambers, one set of circuit-isolating plug chambers, an instrument transformer chamber with its own oil tank and a cable box, together with interconnecting chamber, supported on two cast-

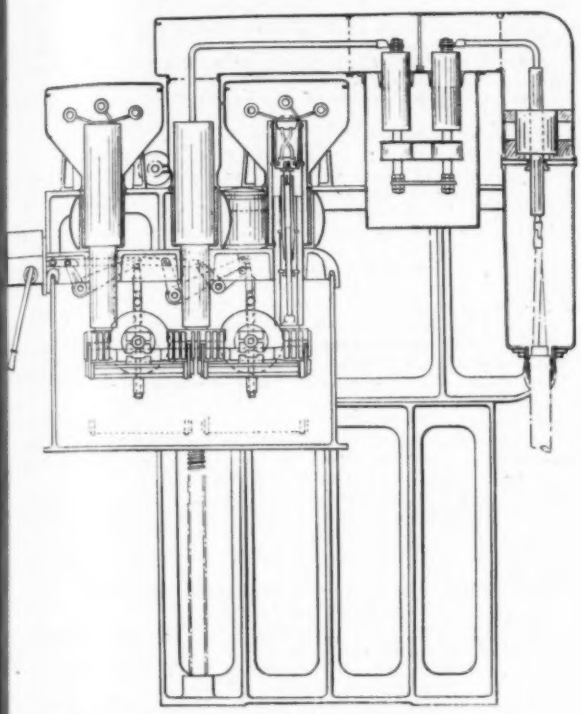


Fig. 1.—Sectional View of New F.P. Armourclad Switchgear.

iron pedestals on which the lowering and lifting gear is also mounted. This makes a self-contained unit and facilitates extensions or re-arrangement of the gear. The draw-out portion consists of the double oil circuit breaker with two operating solenoids, together with hand-operating levers for emergency control, two trip coils, auxiliary switches for working indicating lamps, &c., and a set of isolating-plug sockets for connection to the fixed portion. The motor is controlled by means of a reversing switch, and at each end travel-limiting switches are so connected in the motor circuit

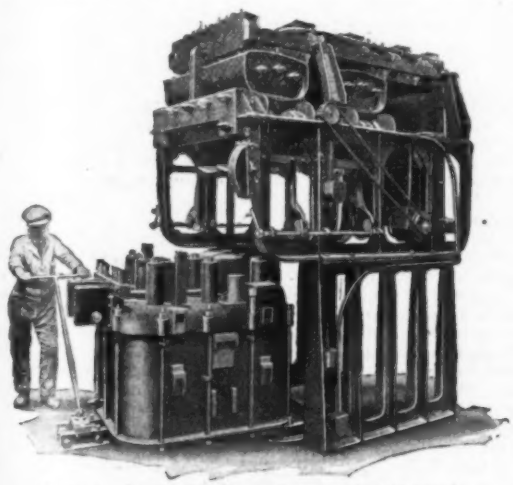


Fig. 2.—New Compound-Filled Switchgear.

as to prevent over-winding. The breaker cannot be lowered out of contact until it is in the "off" position, which is accomplished by wiring the motor circuit in series with an auxiliary switch on the breaker, thus preventing the e.h.p. main current being broken on the isolating plugs. Furthermore, the tank cannot be removed until the breaker is disengaged from the live contacts. The complete draw-out portion can be lowered on to a bogie for removal, fig. 2, and when the breaker is disengaged the live chambers are automatically screened by means of hinged caps which move over the holes through which the plugs have passed, fig. 3.

Where potential transformers are required they are mounted in a separate oil tank which is provided with isolating plugs. The transformers, together with their h.p. fuses and limiting resistances, are suspended in a chamber from the top casting in a similar way to the breaker mechanism. Lowering arrangements on the lines of those of the main breaker are provided so that it is possible, first, to isolate the transformer, and then, by continued lowering, to remove the tank for inspection of fuses and resistances; in this case, however, a worm-wheel winch is used. The potential transformer can be isolated without making the main circuit dead, and shutters automatically close over the live terminals when the transformer is withdrawn.

The oil circuit breaker tank is provided with steel separators between phases, and the whole of the inside is lined with insulating material. An oil and gas separator with suitable baffles and valves is so arranged that the gases are allowed to escape, but the oil is returned to the tank for further use after the pressure has subsided.

The insulation used throughout is bakelite. The moving breaker contacts are copper tubes, the ends of which are pressed to "V" shape and slotted at the apex to hasten the introduction of oil to the point of rupture.

Accelerating springs are fitted, and retardation at the end of the stroke is accomplished by means of plungers cushioned in an oil dash pot.

The F.P. "super-sensitive" trip coil* is incorporated, and discriminative protective gear can be made to trip the breaker (without the use of relays and auxiliary supplies) with fault currents as small as 30 amperes, with straight-through type current transformers. Both the plugs and sockets are detachable without interfering with the compound filling and

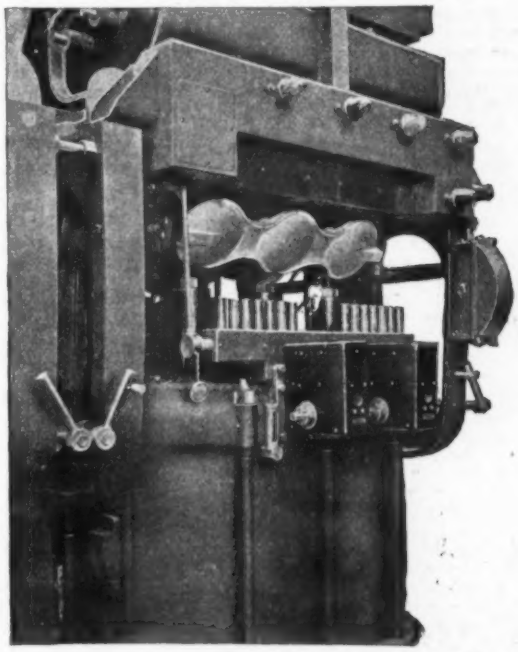


Fig. 3.—Automatic Screening Shutter.

their bakelite insulators are of the condenser pattern. The plug insulators are protected from dripping water when used in damp situations, and the unit can readily be adapted for outdoor service.

In addition to the ordinary interlocks a special interlock is incorporated to prevent the switch being inadvertently used as a busbar coupler, and indicating lamps are provided on both the h.p. units and the control board to show whether the breakers are "on" or "off," and to indicate to which busbars they are connected.

A New Light Ray.—The discovery of a new light ray which may "prove to be the secret force required for the disintegration of the atom" was announced recently to the American Association for the Advancement of Science by Prof. W. D. Harkins, of the University of Chicago. He exhibited photographs (of which altogether he had taken 40,000) showing the bombardment of the nucleus of an argon atom by an Alpha particle shot at it by a radio-active substance at the rate of 10,000 miles a second—25,000 times faster than the fastest rifle bullet's speed. The photographs revealed after the impact a backward-curving ray named "Zeta" by the professor. This discovery, he predicts, "will make revolutionary changes in the field of physics."—*Daily Mail.*

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* ELECTRICAL REVIEW, June 29th, 1923; p. 1020-21.

Reviews.

Electro-Chemistry Related to Engineering. By W. R. COOPER, M.A., B.Sc., M.I.E.E., A.M.Inst.C.E., F.Inst.P., A.I.C. Pp. xiv+136; figs. 58. London: Constable & Co., Ltd. Price 12s. 6d. net.

This is a volume in the Treatise of Electro-Chemistry planned by the late Bertram Blount, and it deals with some of the miscellaneous phenomena or processes where electro-chemistry is of direct interest or application to the engineer. Such processes as the electro-refining of copper or the production of aluminium, steel and other products in the electric furnace are not included—they are dealt with in other volumes of the treatise—but there are one or two other omissions of subjects that might suitably have been included. For example, electrodeposition of iron, copper, and other metals is now being used for the building-up of worn and under-gauge parts of aeroplanes, for lining aeroplane engine cylinders, and similar purposes. During the war the driving bands on shells were often electrodeposited, while in America, at least, copper casting patterns are now being made by the same method.

The first three chapters deal with harmful electrolytic reactions; the corrosion of underground iron pipes and lead-covered cables by stray earth currents, and the corrosion of condenser tubes. In such cases it is necessary for the engineer to understand the cause of the trouble before he can have an intelligent understanding of the remedies in use. To that understanding, anyhow in the broad sense, he will readily attain after a careful perusal of Mr. Cooper's simple, clear exposition. We wonder how many electrical engineers know that electric osmosis is responsible for the fact that the insulation of a negative underground cable is never so good as that of the corresponding positive cable?

To the chapters on corrosion the author might have added a section on atmospheric corrosion, which surely is of interest to the structural engineer, unless, indeed—which is unlikely—he does not subscribe to the electro-chemical explanation of that group of phenomena. Perhaps it is that, although electro-chemistry may explain the cause it has not yet suggested a remedy. And yet, has it not pointed a possible way to a remedy? Chapter V deals with the electrical precipitation of dust, smoke and fume. If the production of deleterious furnace products cannot be prevented, their harmful effects can at least be minimised by a removal of their solid constituents, and the pictures on pages 82 and 83 of this book are eloquently suggestive of some possibilities in this direction. This precipitation process, however, is intended to do good as well as to prevent evil. The isolation of the potash-rich dust from blast furnace gases may result in an important supply of that mineral, which does not occur naturally in this country, so essential to the glass manufacturer and the farmer.

Of more special interest to the electrical engineer is the purification by cataphoresis (the transfer of colloidal particles through a medium by the application of an electric force) of crude china clay, the basis of one of his most important insulating materials. Mr. Cooper describes the Schwerin process, and tells us it is being worked on a large scale in Austria, Germany and Spain. Another interesting process described in Chapter IV is Tate's process for water-proofing fabrics, in which aluminium hydroxide produced electrolytically is carried into the capillaries of the fabric by cataphoresis, and there converted into basic aluminium oleate. During the war the process was largely used in America and in 1920 the plant at Rhode Island is stated to have had a capacity of 30,000,000 yd. per annum.

Chapters on "Electro-Culture" and "The Relative Importance of Cheap Power and Cheap Freights" complete the book. The feature of the latter is the instructive table on p. 132 giving the energy consumption per ton, market price, cost of power, and the relation between cost of power and market price, for the principal electro-chemical products now being manufactured. The table tells one at a glance why certain products—such as aluminium, calcium carbide or ferro-alloys—can only be economically produced in localities where power is cheap and why in other cases, such as electrolytic copper, caustic soda or graphite, the power item is not the decisive factor.

It is impossible, at present, to arrive at a reasoned conclusion with regard to the prospects of electro-culture. Not only is the evidence conflicting, but so many factors have to be disentangled one from the other, that years must elapse before such a conclusion can be reached. On the face of it, however, there is a good case for continuing to study the problem. Admirable work is being carried out at the Rothamsted experimental station, and we learn from an interim report of this work that "the effect of electrification in increasing yield of spring-grown oats and barley has been demonstrated." The farmer has already to thank the electro-chemist and electrical engineer for having provided him with artificial fertilisers. His debt will be enormously enhanced in the not impossible event of electricity helping to make two blades of corn grow where previously only one grew.

Every progressive electrical engineer on the look-out for new worlds to conquer should read and ponder over this interesting and suggestive little book.

Modern Radio Communication. By J. H. REYNER, B.Sc. (Hons.)A.C.G.I., L.I.C. Pp. vi+208; figs. 121. London: Sir Isaac Pitman & Sons, Ltd. Price 5s. net.

This is a textbook covering the syllabus of the City and Guilds examination, and explains the fundamental principles of radio telegraphy and telephony, with their up-to-date application. An elementary knowledge by the student of mathematics, and of the principles of electricity and magnetism is assumed.

The book is especially suitable for those who wish to understand fundamental principles without spending time on the detailed study of methods and apparatus which, though of historical interest, are now obsolete in practice. It makes no pretence to deal exhaustively with aspects of the subject which necessitate the use of advanced mathematics, and, as Professor Howe says in a foreword, the author has made a wise and discriminating use of the formula "it can be shown."

Mr. Reyner writes with authority on the up-to-date applications of radio communication, as he is in the Wireless Section of the Engineering Department of the Post Office, and makes full use of his knowledge of what is, and what is not, of really practical importance; in other words, he lays stress on the former, and, rightly, in a book of this size and scope, completely ignores the latter.

All present practical applications are dealt with simply and concisely, so concisely indeed that one would have liked to see a little expansion in the matter dealing with valve receiving circuits even if it had necessitated some omissions elsewhere, and in revising for a second edition the following details might also receive attention:

The statement that Ohm's law is universally true, on page 2.

The method of showing H.T. batteries in diagrams.

The phrase "circular formers," on page 14.

The statement that it is customary to refer to wave-length rather than frequency, on page 57.

The statement that modern practice tends to the adoption of self-supporting towers, on page 192.

Misprint of "election" for "electron," on page 195.

But these are only a few suggestions of little importance for the improvement of an excellent book, which we have no hesitation in recommending to all serious students as a sound up-to-date introduction to the theory and practice of radio communication.

Alternating-Current Protective Systems and Gear. By J. HENDERSON, B.Sc., M.C., and C. W. MARSHALL, B.Sc., A.M.I.E.E. Pp. xii + 108, figs 32. London: Sir Isaac Pitman & Sons, Ltd. Price: 2s. 6d. net.

This little work forms one of the rapidly increasing number of volumes contained in the series known as Pitman's Technical Primers, and, as is the case with most of the units contained in the series, is distinguished by the essentially practical character of the information put forward.

It is an extremely difficult matter at the present time to write a satisfactory book on protective systems, partly owing to the large number of schemes put forward by different inventors and partly owing to the varying circumstances under which protection is required in alternating current systems. That great diversity of opinion exists amongst experts on the subject may be gathered from a perusal of the discussion following the reading of any paper dealing with the subject before our technical societies. In the present volume the magnitude of the authors' task is increased by the limited space at their disposal, and it would seem that any points in the book to which criticism may be directed are, in the main, due to the difficulties outlined above.

Most of the methods which have been put forward for cutting out defective circuits and machines on the occurrence of earths or short circuits are described and (what is equally important) compared, though there is too little attention devoted to the case of shorts between the turns of one phase of a machine, and in this connection we would welcome some account of the mid-point system of protection, which has recently excited some attention. An application of the McColl biased circulating current system is illustrated in Fig. 13, and it is stated that no current flows through the operating coils of the relays so long as conditions are normal; with the connections given, it does not seem that this statement can be correct even if the drop in the pilot wire is, as stated, kept as low as possible. On page 64 it is implied that McColl's gear may be used for cutting out an alternator in the event of the occurrence of a short between the turns of one phase; unfortunately the diagram of the necessary connections is not given, and some readers may spend much time in pondering as to the manner in which it is effected.

A little more information as to the underlying principles of certain formulae in the first chapter is probably desirable, but the book may be well recommended to all those engaged in power station work, and should be particularly useful to those who wish to obtain an insight into the possibilities and weaknesses of modern protective gear.

Electrical Measuring Instruments and Supply Meters. By D. J. BOLTON, B.Sc., A.M.I.E.E. Pp. xvi+328; figs. 180. London: Chapman & Hall, Ltd. Price 12s. 6d. net.

Electrical measuring instruments have never received the attention they deserve from engineers of all classes, and the literature of the subject is so scanty that there is plenty of room for good books. Mr. Bolton's aim has been to produce a book giving all the information regarding electrical instruments required by the general engineer. The subject is dealt with in eighteen chapters. The first eight chapters are devoted to indicating instruments—ammeters, voltmeters, and wattmeters. Three chapters on supply meters (Mr. Bolton's term for ampere-hour and watt-hour meters and demand indicators) follow. The remainder of the book deals with galvanometers, oscillographs, standardisation, frequency and power factor meters, synchroscopes, iron testing, and pyrometers. The reasons for setting out the work in this order, if there be any, are beyond the reviewer's understanding. The descriptions of indicating instruments are very clear, but most of the diagrams are very sketchy. The inclusion of one or two dimensioned drawings would be a distinct improvement. The section dealing with supply meters is very useful, and this part is itself sufficient to justify the production of the volume. The oscillograph galvanometer is described fairly well, but the information given is not of much value to an oscillograph operator as the optical system, which is the chief source of difficulty, receives very scanty attention. The explanations of the working of frequency meters, power-factor meters, and synchroscopes are quite good, but there is still room for a really conclusive treatment of the subject. The last chapter gives a useful summary of the chief features of electrical pyrometers. This section is specially recommended to power station engineers in the hope that they may also read the whole book and so dispel to some extent their alleged abysmal ignorance of the instruments on which they are so dependent. Many useful examples (with answers, and in some cases complete solutions) are included, and these should be very valuable to any reader who is anxious to get a thorough grip of the subject.

A serious omission lies in the lack of any reference at all to power station summation meters, which are becoming increasingly important as aids to efficient running.

The work of the printers is excellent, but many of the illustrations are very hackneyed.

On the whole, the book is very good, and can be recommended with confidence to those for whom it was produced.

Legal.

Old Bailey Charge and Sentence.

BEFORE the Common Serjeant (Sir H. F. Dickens, K.C.), at the Central Criminal Court, on January 14th, the hearing was concluded of the case against Edmund George Thomas Davis, 45, described as an engineer, who surrendered to his bail and pleaded not guilty to an indictment which charged him with obtaining various sums of money ranging from £100 to £200 by false pretences.

Mr. Percival Clarke and Mr. Eustace Fulton appeared for the Director of Public Prosecutions, while the accused conducted his own defence.

On behalf of the prosecution it was alleged that the accused had obtained money from various people to whom he promised employment. He advertised "Permanent employment guaranteed for £100 investor. Full security with a limited company." Money was obtained from applicants for employment but little work seemed to be done. The defendant carried on business as the Perfecto Electrical Co. at 33a, The Broadway, Hammersmith, while it was also stated that there was a factory at Northcote Works, Isleworth.

Mr. H. L. HOUGH, electrical engineer, of Poole, Dorset, stated that he answered the advertisement and had an interview with the defendant, who told him that he had previously carried on business as the Enterprise Engineering Co. After the interview the accused wrote that he had seen 30 other applicants, but favoured witness, to whom he offered a position at £4, rising to £5 a week. Witness accepted the offer and handed over £150 to the defendant.

COUNSEL: Did you know that the Perfecto Electrical Co. consisted of the defendant and his wife?

WITNESS: I only found that out after I had paid my money. He added that later the defendant told him it was a common thing to use other people's money, and "that it was only my money he wanted." Finally he gave notice that he required his money back and the defendant promised to repay.

COUNSEL: Where was the money to come from—heaven?

WITNESS: No, from other investors. He went on to state that he saw drafts of other advertisements in the office, where investors were being asked to put up £500 in return for good wages, while their capital would be secure with an electrical company. He finally received a cheque for £50 from the accused, but the bank returned it marked "R.D."

Similar evidence was given by several other witnesses, one of whom stated that he parted with £200. With regard to the "factory" at Isleworth, evidence was given that it was a private house and there was not even a shed in the back garden. A witness from the bank stated that the defendant's account was overdrawn to the extent of £640, and he had been allowed an overdraft on the strength of certain electrical contracts he had secured.

The defendant gave evidence denying the charge, and stated that the Perfecto Electrical Co. was a genuine business, which he founded with a capital of £30. He never intended to defraud anybody. At the outset only small installations were carried out, but later big contracts were secured. He had had to employ trade union men and pay trade union rates. The trade union rate for a labourer was £3 14s. a week. The people who invested money in the concern never troubled so long as their wages were paid and they should have reported to him that the workers were slack on the different jobs. The Perfecto Electrical Co. was not registered as a limited liability concern and it lasted for about 15 months. His idea was to make the Perfecto Electrical Co. one of the best concerns in the trade and it would have been successful if it had continued for a few months longer, whilst all the people who had put up money would have been repaid.

In cross-examination the defendant stated that the proposal was to turn the Perfecto Electrical Co. into a limited liability concern and repay the investors. The money received from the investors had been lost on the contracts.

Counsel suggested that in addition to the money due to the investors there were liabilities owing to the wholesale houses and manufacturers for goods supplied. He asked if the total liabilities were about £3,000, and the defendant replied that they were £2,150.

The jury found the defendant guilty and he was sentenced to 12 months' imprisonment, with hard labour.

Geo. Routledge & Sons, Ltd., v. Baines.

IN the Mayor's and City of London Court, on January 15th, before Judge Shewell Cooper, plaintiffs, publishers, claimed £38 9s. 9d. against Mr. A. E. Baines, director of Baines Dielectrics, Ltd., 2 and 4, Tudor Street, E.C., balance due on a royalty account and for goods supplied. Mr. F. Hinde, for the plaintiffs, said that defendant was an author, and plaintiffs had published several books which defendant had written. In July, 1918, defendant was proposing to publish a further book on "Germination from an Electrical Standpoint," and he wanted some cash in advance. The system on which previous books were published was that the defendant should be paid by royalties. Plaintiffs agreed to advance defendant £75. £40 had been worked off for royalties, leaving the amount sued for due. Mr. Evans, for the defendant, said that the defence was that the £75 was an advance on account of royalties and not a loan. Mr. STALLYBRASS, plaintiffs' senior managing director, said that the book on "Germination from an Electrical Standpoint," had been rather, on the whole, unsuccessful. The sales were almost nothing now. They spent £20 or £30 in advertisements. It was an edition of 1,000. An edition sold in America, but there had not been a second order. Mr. BAINES, the defendant, said he was to have had 10 per cent. on the published price of 12s. 6d. There was no time for repayment of the £75. Therefore it was not a loan. It would be worked off all right by the sale of his books. He lived at 101, Stour Road, Christchurch, Hampshire. He was astonished at the action being brought. Judge SHEWELL COOPER found for the plaintiffs for £38 9s. 9d. and costs.

Theft of Electricity.

AT Cheltenham Police Court, recently, Albert E. Dunn was prosecuted by the Corporation for the fraudulent consumption of electricity. The Town Clerk stated that the defendant was an electrician and wiring contractor. His supply was disconnected on May 25th last and the main fuse box was sealed up. Upon suspicions expressed by the Corporation's mains superintendent, defendant's premises were visited by the police, who discovered that seven rooms were being lighted by electricity. The meters showed that about 40 kWh had been used. The defendant pleaded that the electricity so used had been measured and so there was no question of his "stealing" the electricity. It would have been possible for him to take electricity without its passing through the meter.

The magistrates imposed a fine of £5.

At Stowmarket, on January 14th, George Ward, a blacksmith, was prosecuted by the East Anglian Electricity, Ltd., for the alleged theft of electricity from the company's mains. A meter inspector, giving evidence against defendant, stated that he found that although the connections at the meter on defendant's premises were disconnected, he could still obtain current. Further inspection revealed a rotary switch which was connected to the service leads at the back of the meter; when this switch was full on no current passed through the meter. The engineer-in-charge of the undertaking said that a general inspection had been carried out because the company found that only 67 per cent. of the energy generated was being paid for. Defendant's son admitted putting the switch in, but said that it was not for the purpose of obtaining electricity fraudulently. The Bench decided to convict the defendant, and fined him £5.

An Electricity Supply Engineer's Claim.

LAST week, in the King's Bench Divisional Court, before the Lord Chief Justice and Justices Moore and Sankey, Mr. Jeeves, K.C., applied, *ex parte*, on behalf of the Torquay Corporation for a rule nisi for certiorari and prohibition against the Ministry of Labour, Sir William Mackenzie and Mr. Smith, the late manager of the Newton Abbot electricity undertaking.

From the particulars published in the local Press, it appears that the rule for certiorari asked that an order of the Ministry of Labour ordering an arbitration, and authorising Sir William Mackenzie to conduct it, should be quashed, and the rule for prohibition to prohibit Mr. Smith for persisting in the arbitration and Sir William Mackenzie from conducting it.

"Counsel said that by the Newton Abbot Electric Lighting Order, provision was made for terms on which the local authority could purchase. An agreement was made by the Newton Abbot Urban Council and the Torquay Corporation whereby it was decided that an option to purchase should be exercised, and the undertaking transferred to the Torquay Corporation. That arrangement was sanctioned by Parliament in 1922, by a local Act, and the transfer was made in due course. No compensation was arranged for, but, as soon as the transfer took place, Mr. Smith, the manager of the Electric Light Company, under the provisions of the Electric Lighting Act (1919 and 1922), made a claim for compensation.

"Counsel submitted that a claim for compensation could not be supported, having regard to the Order under which the transfer was made, but the Ministry of Labour had asked Sir William Mackenzie to conduct an arbitration to go into Mr. Smith's claim. He contended that the Ministry of Labour had no jurisdiction to make the order."

The Court granted the rule, which will come up for argument in due course.

Charges Against Dundalk Consumers Dismissed.

AT Dundalk District Court, Mr. Patrick Moore, Church Street, was charged at the suit of the Urban Council's electricity department with wastage or diversion of a quantity of electricity. The case for the prosecution was that Mr. Moore, a prominent merchant, had had installations made in his premises for lighting and heating, and that he had used current from the heating meter for lighting purposes, the heating supply costing 4d. per unit and the lighting 10d. per unit. It was admitted that Mr. Moore's was probably the most brilliantly lighted house in the town, but the contention was that he was using very little electricity for lighting in comparison with the returns for other people in business in the same locality, who had practically the same number of lamps and who did not use them to the same extent. A meter inspector, Michael McCoy, deposed to visiting the premises and finding that the current for window lighting was registered in the heating meter, and not in the lighting meter.

The defence was a denial of the charge, and an assumption that a comparison of meters with the previous year's readings showed that there had been no malpractice. Mr. Thos. Curran, electrical engineer, Dundalk, and Mr. A. E. Porte, M.I.E.E., Dublin, were called in support.

The Court held that there were suspicious circumstances in the case, but no evidence upon which a conviction could be based. A dismissal on the merits was granted.

Daniel and Thos. Levy, Clanbassil Street, were also summoned for alleged diversion of electricity, the prosecution stating that a light in the defendants' shop was taken from a battery charge meter. The defence in this instance was that the lamp was used to show that a battery was being charged. The Court ruled that a doubt existed, and gave defendants the benefit, entering a dismissal.

Electric Lamp & Supplies Co., Ltd., v. Kelly & Tarshis.

IN the Shoreditch County Court, on January 17th, before Judge Cluer, the hearing was resumed and concluded of this action, in which plaintiffs sought to recover £44 17s. for cable supplied. There was a counterclaim for £50. At the previous hearings of the case one or the other of the defendants were ill, and the case was adjourned, and on the last occasion the case was adjourned on the terms that the defendant should pay the costs thrown away, but Mr. Willis now said that this had not been done, and they had received intimation that the defendants did not intend to go on with the action.

Judge CLUER: I might have known that from the start. I was reluctant to adjourn the case.

Mr. F. G. WILLIAMS, traveller to the plaintiffs, said that he sold the cable. In April of last year he called for the money for what had been delivered, but they said they would pay when the balance was delivered, and he told them that no more would be delivered until the account was paid.

Judge CLUER gave judgment for the plaintiffs for the amount claimed and costs, and also gave judgment for them on the counterclaim with costs.

Shipowner Summoned.

AT the instance of the Director of Public Prosecutions, Edward Olivier, part-owner of the steamship *El Kahira*, was summoned at the Mansion House on January 16th. It was stated for the prosecution that the ship in question was not fitted with a wireless telegraph installation as required by the Merchant Shipping (Wireless Telegraphy) Act, 1919, and during a voyage from London to the Piræus was lost with all hands on July 9th, 1922. That was an indictable offence under the Act for which a maximum fine of £500 could be imposed.

Giving evidence before a subsequent Court of Inquiry, the defendant said that he did not consider that an installation was necessary for a vessel on such a short voyage. He intended to transfer the equipment from another ship to the *El Kahira*. The hearing was adjourned for a week.

Published Specifications.

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS, Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1922.

15,681. "Automatic electric switches." F. B. Cox. June 20th, 1922. (208,731.)

17,393. "Electrical apparatus, particularly for changing the frequency of wave-form of alternating currents." J. Scott-Taggart and Radio Communication Co., Ltd. June 23rd, 1922. (208,735.)

17,667. "Oscillating dynamo-electric generators." H. Baron (Signal Gen.). June 27th, 1922. (208,736.)

17,668. "Electromagnetic vibrators, telephones, or the like." Signal Gen. August 1st, 1921. (184,154.)

20,485. "Manufacture of plates for electric storage batteries or accumulators." F. C. Thornley, F. F. Tapping, and O. Reynard. July 26th, 1922. (208,744.)

23,062. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. October 11th, 1921. (187,208.)

25,475. "Housings or mountings for electrical switch or fuse panels, particularly for electric ranges." E. C. R. Marks (Walker & Pratt Manufacturing Co.). September 20th, 1922. (208,759.)

25,477. "Means for electrically heating gases under pressure for use in the catalytic production of ammonia." J. Y. Johnson (Badische Anilin and Soda Fabrik). September 20th, 1922. (208,760.)

25,631. "Head lamps of road vehicles." H. Dowell. September 22nd, 1922. (208,763.)

25,865. "Electro-mechanical starting and stopping device, primarily designed for actuating photographic shutters, but applicable also for actuating other devices." C. G. Lowen, C. P. Lingwood, and Pictorial Machinery, Ltd. September 25th, 1922. (208,773.)

25,977. "Electrically-operated switches for controlling lighting or other circuits on railway vehicles or the like." Vickers, Ltd., and J. Echells. September 26th, 1922. (208,780.)

25,984. "Manufacture of jacks for telephone switchboards." M. B. Richter. September 26th, 1922. (208,782.)

25,995. "Electric furnaces." L. Tagliaferri. September 26th, 1922. (208,786.)

26,091. "Power transmission device." Metropolitan-Vickers Electrical Co., Ltd. October 25th, 1921. (187,951.)

26,213. "Miners' electric lamps." Thor Electric Safety Lamp Co., Ltd., and T. Stretton. September 28th, 1922. (208,799.)

26,312. "Squirrel-cage electric motors." A. Arutünoff. September 29th, 1922. (208,804.)

26,431. "Telephones." R. H. White. September 30th, 1922. (208,808.)

26,452. "Inductance coils used in connection with wireless receiving apparatus." Igranic Electric Co., Ltd., A. H. Curtis, and S. R. Wright. September 30th, 1922. (208,809.)

28,098. "Electric snap-action switches." Ward Leonard Electric Co. July 29th, 1921. (Divided application on 20,579/22.) (187,244.)

28,444. "Radio telephonic and telegraphic systems." H. J. Lucas and A. J. Hurst. October 19th, 1922. (208,848.)

32,260. "Rotor windings for dynamo-electric machines." Ateliers de Constructions Electriques de Charleroi. November 26th, 1921. (189,470.)

32,764. "Drag magnets for apparatus such as electric meters." British Thomson-Houston Co., Ltd. (General Electric Co.). November 30th, 1922. (208,887.)

33,604. "Electrical transformers." M-L Magneto Syndicate, Ltd., and D. K. Morris. December 8th, 1922. (Cognate application, 10,196/23.) (208,895.)

1923.

312. "Electric switches actuated by the movement of a vehicle door or the like." Sunbeam Motor Car Co., Ltd., L. Coatalen, and H. M. Weir. January 4th, 1923. (208,919.)

1,330. "Safety apparatus for mercury-vapour high-vacuum ejecters." Akt. Ges. Brown, Boveri et Cie. June 6th, 1922. (198,986.)

2,075. "Electric annealing, hardening, and smelting furnaces." O. Carell. January 24th, 1922. (192,386.)

2,692. "Electrical measuring instruments." J. W. Record. January 30th, 1923. (208,939.)

4,357. "Electron discharge devices." British Thomson-Houston Co., Ltd. February 28th, 1922. (194,279.)

5,523. "Radio receiving instruments." A. C. Sandy and W. Howard. February 26th, 1923. (208,951.)

6,355. "Incandescent electric lamps." G. Weissmann. March 4th, 1922. (194,318.)

8,239. "Variable electrical condensers." W. Dubilier. July 20th, 1922. (201,138.)

8,348. "Transformers for alternating-current motor starting switches." A. S. Wheeler (legal representative of S. S. Wheeler (deceased)). October 25th, 1922. (Divided application on 198,614.) (208,964.)

14,452. "Switches for electric welding machines." E. Schröder. June 1st, 1923. (208,987.)

15,777. "Electric current collecting brush devices." Metropolitan-Vickers Electrical Co., Ltd. July 5th, 1922. (200,495.)

16,598. "Vibrators for alternating-current rectifiers." C. E. Ogden. October 2nd, 1922. (204,678.)

20,140. "Process and apparatus for exciting mercury-vapour rectifiers that run idle at times." Akt. Ges. Brown, Boveri et Cie. August 7th, 1922. (201,944.)

22,026. "Speed-controlling devices for railway, tramway, and similar trains." E. Rodolausse. December 11th, 1922. (Addition to 182,617, as modified by 180,698.) (Divided application on 206,040.) (209,003.)

24,096. "Electron discharge devices." Western Electric Co., Ltd. November 20th, 1922. (207,161.)